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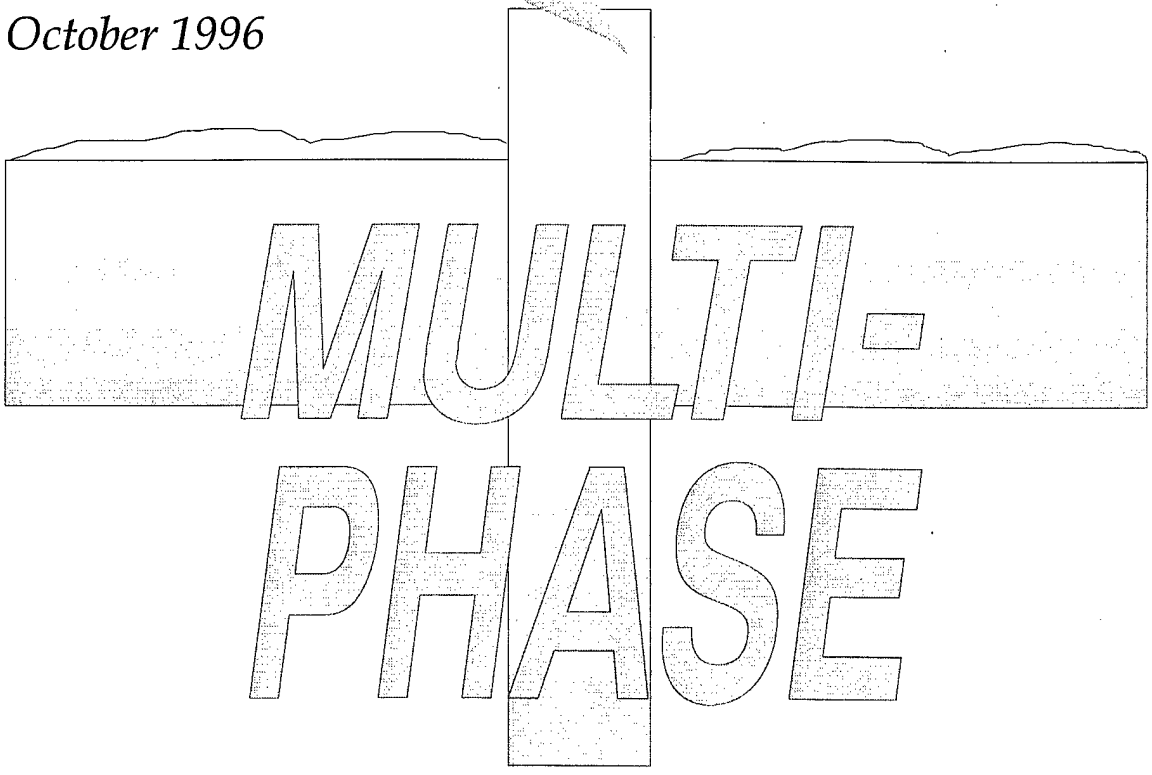
Ellsworth AFB Pride Hangar

Multi-Phase Pilot Test Technology Evaluation Report

FINAL

Ellsworth Air Force Base
South Dakota

October 1996



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7 October 1996

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U.S. Army Corps of Engineers, Omaha District
ATTN: CEMRO-ED-EB (Robert Zaruba)
215 North 17th Street
Omaha, Nebraska 68102-4978

SUBJECT: Contract No. DACA45-93-D-0027, Delivery Order No. 27, Mods 04 and 05; Final Ellsworth AFB Multi-Phase Pilot Test Technology Evaluation Report, Pride Hangar Site

Dear Mr. Zaruba:

Enclosed are two (2) copies of the final Ellsworth AFB Multi Phase Pilot Test Technical Evaluation Report performed at the Pride Hangar Site. I have forwarded two copies to Ms. Margaret Calvert at ACC CES/ESVW, Langley AFB, two copies to Mr. Dell Petersen at Ellsworth AFB, one copy to Peter Ismert at EPA Region VIII, one copy to Mr. Ron Holm at the State of South Dakota, two copies to Mr. Keith Anderson at RUST, and one copy to Mr. Robert Todd at EA.

If you have any questions regarding this deliverable please contact me at (916) 857-7281 or Mr. Bill BuChans at (423) 483-9870.

Sincerely,

Francis E. Slavich, P.E.
Program Manager

c: Ms. Margaret Calvert, ACC CES/ESVW, Langley AFB (2)
Mr. Dell Petersen, Ellsworth AFB (2)
Mr. Peter Ismert, US EPA (1)
Mr. Ron Holm, SDDENR (1)
Mr. Keith Anderson, RUST (2)
Mr. Robert Todd, EA (1)
Bill BuChans, Radian (1)
James Machin, Radian (1)
Suzanne Sellers, P.E., Radian (1)
Project File, 612-001 (1)

ELLSWORTH AFB
MULTI-PHASE PILOT TEST
TECHNOLOGY EVALUATION REPORT
FOR PRIDE HANGAR SITE

at
Ellsworth Air Force Base
South Dakota

FINAL

Prepared for:

U.S. Army Corps of Engineers
Omaha District
ATTN: CEMRO-ED-EB
215 North 17th Street
Omaha, Nebraska 68102

Prepared by:

Radian Corporation
1093 Commerce Park Drive, Suite 100
Oak Ridge, Tennessee 37830
Doc. #D960711.4

October 1996

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ACRONYMS

ACC	Air Combat Command
AFB	Air Force Base
BGS	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DCA	Dichloroethane
DCE	Dichloroethylene
DNAPL	Dense Nonaqueous Phase Liquid
EPA	U.S. Environmental Protection Agency
ESVE	Enhanced Soil Vapor Extraction
FPTA	Fire Protection Training Area
GAC	Granular Activated Carbon
HQ	Headquarters
IRA	Interim Remedial Action
LNAPL	Light Nonaqueous Phase Liquid
MCL	Maximum Contaminant Level
MPE	Multi Phase Extraction
O&M	Operation and Maintenance
OU	Operable Unit
PCE	Tetrachloroethylene
PREECA	Presumptive Remedy Engineering Evaluation/Cost Analysis
PVC	Polyvinyl Chloride
RI	Remedial Investigation
SVE	Soil Vapor Extraction
TCE	Trichloroethylene
TPE	Two-Phase Extraction
USAF	U.S. Air Force
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
µg/L	Micrograms per Liter

1.0 INTRODUCTION

In May 1996, Ellsworth Air Force Base (AFB), in Rapid City, South Dakota, and Radian Corporation (Radian) completed a three-day pilot treatability test at the Pride Hangar Site of Operable Unit 11 (OU-11) using Two-Phase Extraction (TPE), one of the Multi-Phase Extraction (MPE) technologies. This report provides a summary of the methodology used during the test, the test results, and base-specific recommendations.

1.1 Purpose/Objectives

On 5 May 1995, Headquarters (HQ) Air Combat Command (ACC) published *United States Air Force Presumptive Remedy Engineering Evaluation/Cost Analysis* (PREECA) (U.S. Air Force [USAF], 1995) as a standardized decision framework specifying the criteria and associated decision logic necessary for implementing a nontime-critical removal action for various commonly used technologies. This decision framework, developed by Radian in conjunction with the U.S. Army Corps of Engineers and the USAF, combines the standard Comprehensive Environmental Response, Compensation, and Liability Act (CERLCA) nontime-critical removal action process with the concept of presumptive remedies and a "plug-in" logic tree approach. The result is a "generic" remedy selection document for all USAF installations that facilitates early and substantial risk reduction at USAF sites. **PREECA applies only to a closely defined subset of conditions** that the USAF has found to be common and that pose sufficient risk to justify nontime-critical removal actions. **This methodology was not intended to be used at sites where the need for cleanup actions is not readily apparent.**

PREECA focuses on remedies that can satisfy the majority of common USAF contamination situations, namely in situ bioventing, soil vapor extraction (SVE), groundwater containment, and capping. **However, PREECA is intended to be updated as new, successful remedies are established.** The USAF is currently gathering extensive cost and performance data at a number of contaminated sites for addition of the MPE technologies which include TPE, low vacuum dual-phase extraction (LVDPE) and high vacuum dual-phase extraction (HVDPE). As part of this effort, HQ ACC has contracted with Radian through the Omaha District Corps of Engineers to evaluate the MPE technologies for inclusion in the USAF PREECA. Radian, in conjunction with the USAF, developed a remedy profile for MPE as part of the PREECA effort.

This report presents the results of the TPE pilot test conducted at Ellsworth AFB in May 1996. It compares the pilot test results to PREECA's remedy profile for MPE and demonstrates that TPE is an effective technology for use at Ellsworth AFB. In addition, it presents data on additional objectives for the pilot test, which were to:

- Demonstrate the contaminant removal effectiveness of the TPE technology;
- Determine the feasibility of installing a full-scale system;
- Collect sufficient engineering data to facilitate the design, installation, and operation of a full-scale extraction and treatment system; and
- Assist in the prevention of contaminant migration, thereby minimizing the threat of exposure to human health and the environment.

TPE was selected for testing at the OU-11 Pride Hangar Site because data in the 1995 OU-11 RI [Engineering, Science, and Technology (EA), 1995] indicated a large "hot spot" of groundwater contamination at the Pride Hangar. Data from the OU-11 RI also suggested a low-moderate saturated zone permeability that may limit the effectiveness of groundwater pump and

treat. The TPE technology is designed to enhance control of groundwater plumes in low- to moderate-permeability formations, as well as to remove contaminants from the saturated and vadose zones.

1.2 Site Background

The Pride Hangar is located in the middle of the flightline area of Ellsworth AFB as shown in Figure 1-1. This site was used as a maintenance hangar, resulting in significant soil and groundwater contamination.

Previous field activities in the area have included installation and sampling of monitoring wells and water level measurements. Data collected from these activities, in addition to data from this project, have been used to characterize the subsurface features and the nature and relative extent of contamination at the site.

1.2.1 Subsurface Features

The Pride Hanger area is underlain by approximately 25 to 30 feet of soil (alluvium) that overlies weathered shale and shale bedrock of the Pierre Shale formation (Figure 1-2). The overlying soil consists of interbedded clay, sand and gravel. The sand units are poorly sorted and mixed with clay and gravely materials. The sand and clay units were expected to have low to moderate permeabilities based on visual inspection. However, the clayey sand and gravel unit present within the saturated alluvium are of relatively high permeability.

The upper portion of the Pierre Shale is weathered and consists of variably fractured light olive gray to dark olive gray clay, which increases in competence with depth. Weathered shale is greater than 5 feet thick in the study area (work in the area of the Pride Hanger did not delineate the depth at which competent shale is encountered). The permeability of the weathered and fractured shale is likely to be low.

Extraction well EW-1 was completed within the overlying alluvium and the weathered shale bedrock. It is screened from 23.5 to 33.5 feet below ground surface (BGS). Depth to groundwater in the well was approximately 20 feet BGS. The saturated alluvial thickness ranges from 8 to 10 feet in the extraction well and adjacent piezometers (P-1, P-2, and MW941103). Hydraulic conductivity in the saturated zone is relatively high in EW-1 (1.4×10^{-2} centimeters per second [cm/sec]) based on a slug test run by Rust environment and infrastructure (Rust) after the conclusion of the TPE test. Groundwater flow direction is to the southeast in the Pride Hanger area.

Data from slug tests conducted by EA, and Rust indicate the geometric mean hydraulic conductivity for the shallow aquifer at Ellsworth AFB is 1.1×10^{-4} cm/s. Figure 1-3 shows the distribution of hydraulic conductivities for the saturated zone across the base. These slug tests were conducted on numerous wells in various parts of the Base. Most wells were screened across the entire saturated zone of the shallow aquifer. This aquifer is quite variable across the Base and consists of heterogeneous mixtures of alluvial material (clay, silt, sand, and gravel) and/or weathered and fractured shale. This results in a rather large spread of hydraulic conductivities as shown in Figure 1-3.

1.2.2 Nature and Extent of Contamination

The 1995 RI identified this site as containing significant volatile organic compound (VOC) contamination in the groundwater. The site is contaminated with a combination of VOCs (primarily TCE up to 7,000 micrograms per liter [µg/L] and purgeable JP-4 up to 2,500 µg/L), which are present mostly in the saturated zone.

By using slug test data from OU-9 (3,500 feet to the south) it was assumed that this site had low hydraulic conductivities. As the TPE test showed, this site was one of the more permeable sites on base. It was also noted that groundwater concentrations were significantly lower during the test than was presented in the

1995 RI. Samples collected from EW-1 during the test indicated TCE concentrations of 97 to 410 µg/L.

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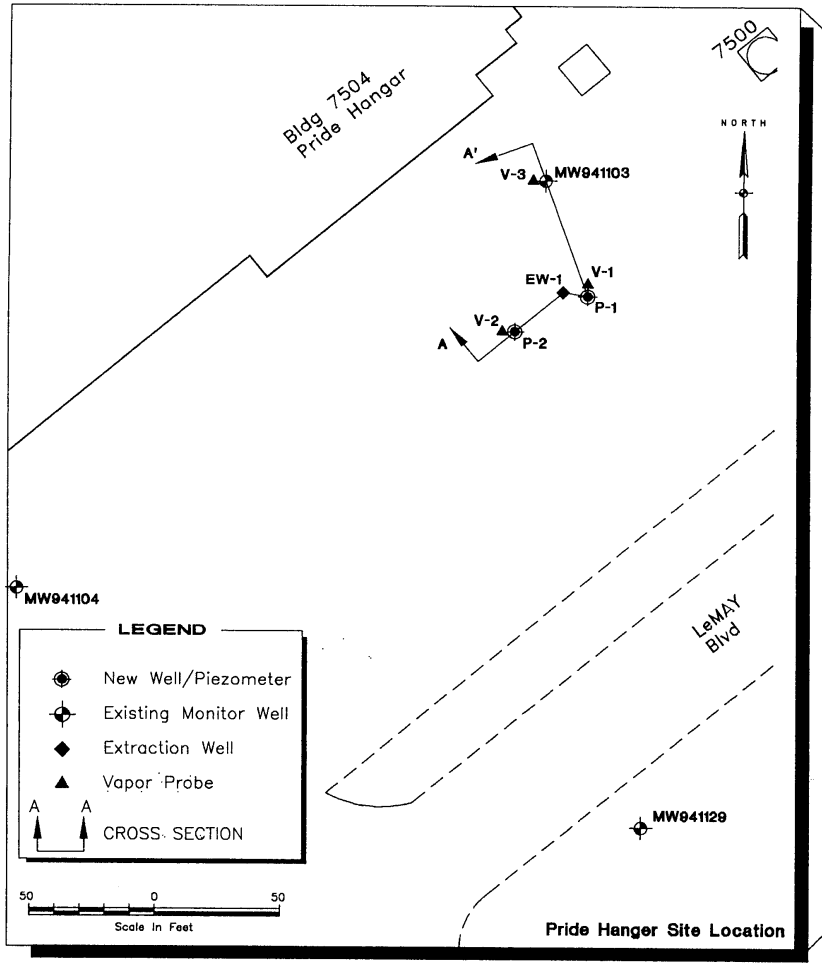

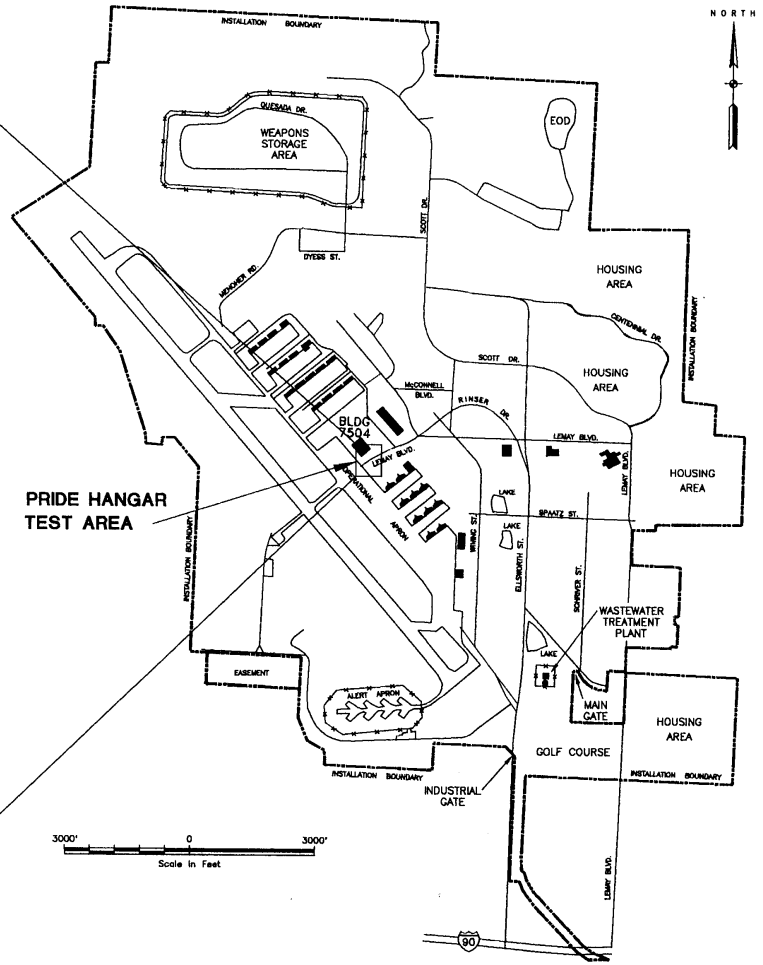

RADIAN CORPORATION ENGINEERING AND ENVIRONMENTAL TECHNOLOGY SERVICES 1093 COMMERCE PARK DRIVE, SUITE 100 OAK RIDGE, TENNESSEE	**Figure 1-1. Pride Hanger Site, Ellsworth AFB**	REV. 0 DATE: 7/24/96	DRAWN BY: W.MEAD CHECKED BY: B.BUCHANS

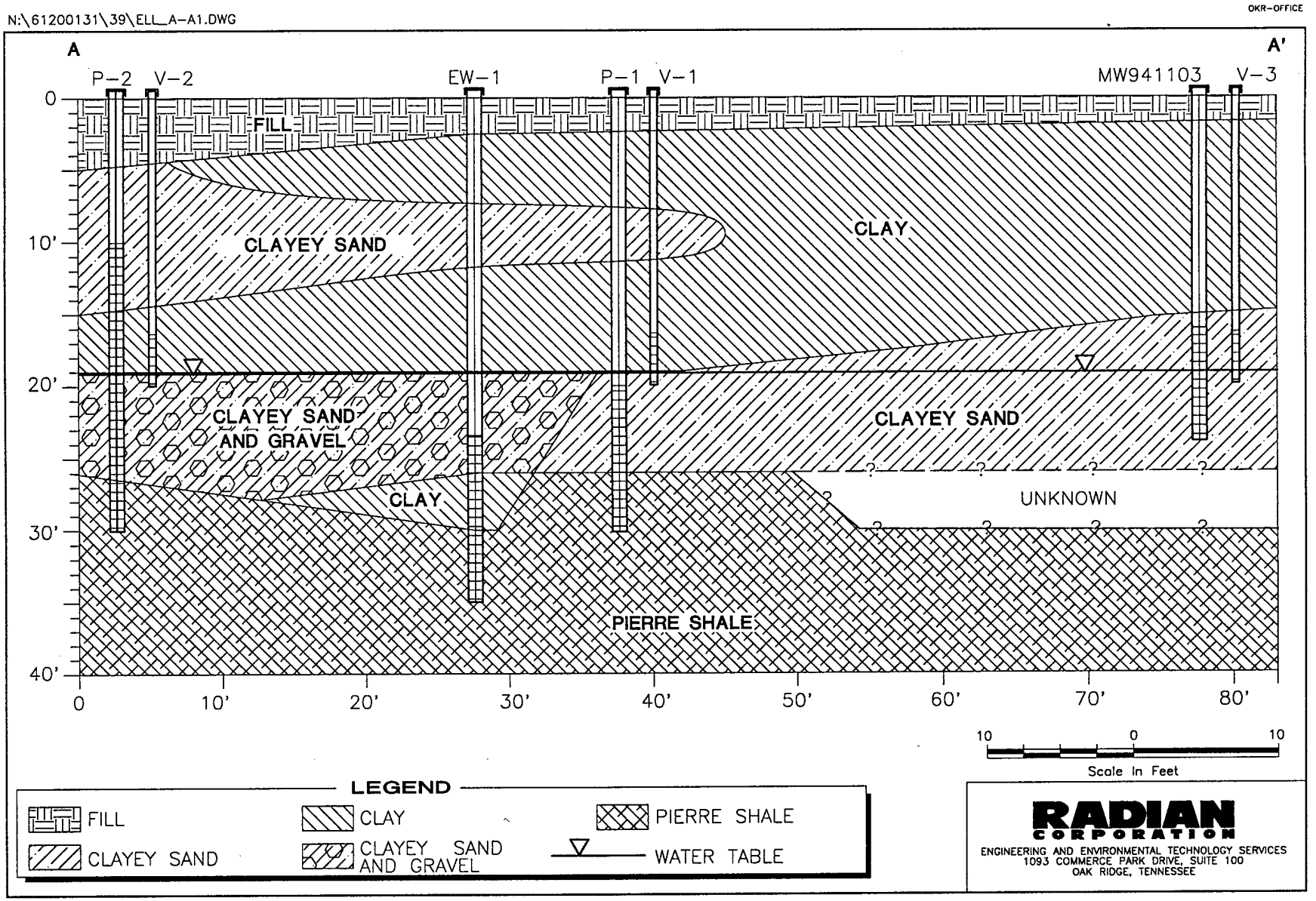

Figure 1-2. Pride Hangar Conceptual Cross-Section

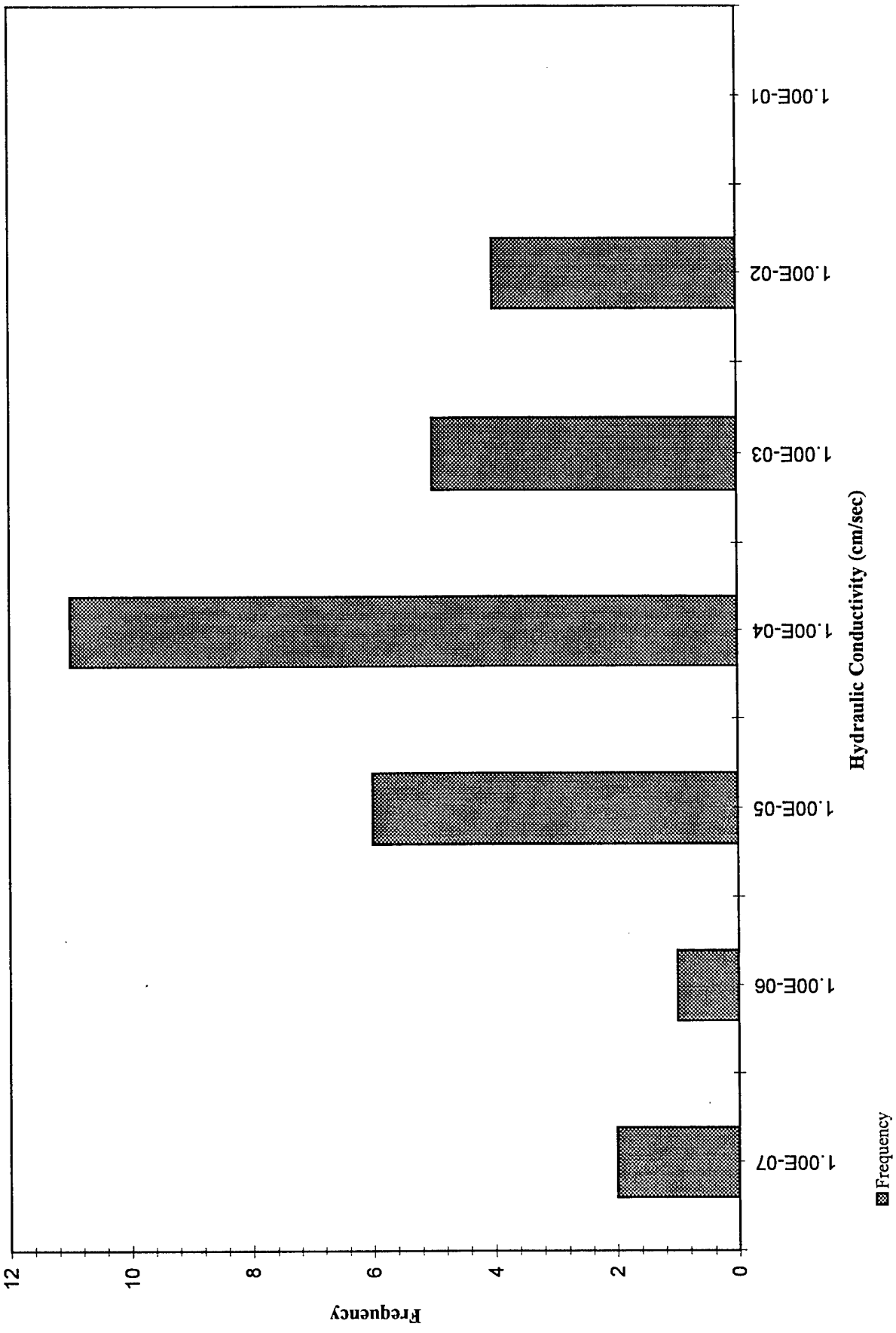

Figure 1-3. Histogram of Hydraulic Conductivities

2.0 TPE EXTRACTION TEST METHODOLOGY

The following information on the technical approach and the sampling and analytical methodologies is a summary of the *Ellsworth AFB Two-Phase Extraction Pilot Test Work Plan* (Radian Corporation, 1996). Additional details are contained in that document.

2.1 Test Procedures

The pilot-scale test of the Two-Phase Extraction system consisted of a three day test conducted in OU-11 on a new extraction well near MW 941103. The test was completed by 16 May 1996. All activities (equipment monitoring, sample collection, sample control, and sample analysis) were conducted in accordance with the procedures and protocols described in the U.S. Environmental Protection Agency (EPA)-approved Ellsworth AFB Quality Assurance Program Plan (QAPP), the Site Safety and Health Plan (SSHP) included in the work plan, and the OU-11 SSHP. The locations of the test wells and monitoring points are shown in Figure 2-1. Well, piezometer, and vapor point characteristics are summarized in Table 2-1. Well logs are included in Appendix A.

2.1.1 Installation of Extraction Well, Piezometers, and Vapor Probes

2.1.1.1 Extraction Well

The extraction well (EW-1) was installed in order to test TPE for the removal of TCE and other volatile organic compounds from groundwater in the Pride Hanger area. The location was selected based upon limited data from previous drilling in the area. Information was not available on the depth to the top of the weathered bedrock or the hydraulic conductivity of the saturated alluvium at the test site prior to installation of the well. Well placement was located in an area of elevated TCE concentrations in groundwater identified in the OU-11 RI report (EA, 1995).

The well was installed on 10 and 11 May 1996 using a hollow stem auger drilling rig with 10-inch outside diameter augers. Soil samples were collected continuously so that a lithologic log could be prepared (Appendix A). The well was constructed with 4-inch diameter polyvinyl chloride (PVC) well casing and screen. The well casing, sand pack, and bentonite seal were installed through the augers to ensure the stability of the well bore. The well screen was placed in the upper portion of weathered shale and in the saturated section of alluvial deposits. The 10-foot long screen was placed from 23.5 to 33.5 feet below ground surface (BGS). A lithologic log and completion detail are contained in Appendix A.

After the well was completed, it was developed to remove silt and clay and ensure communication with the aquifer. The well was purged using a disposable bailer. Water quality was monitored during development by visually observing the silt and clay content of the water and by pH and turbidity measurements. Development was judged complete when the pH was stable and turbidity of the water had decreased to the satisfaction of the supervising geologist. Development logs are contained in Appendix A.

Soil samples collected during drilling of the extraction well indicated that the saturated alluvial sediments at the site were similar in composition to those found in other areas of the installation.

2.1.1.2 Piezometers and Vapor Probes

Piezometers: The piezometers (P-1 and P-2) were installed in order to monitor the response of the aquifer to the test. Piezometers were located at distances of 11.6 and 21.3 feet from extraction well EW-1. An existing monitoring well, MW941103 was located 48.9 feet from EW-1. The locations were chosen such that data from the wells provided data on the response of the saturated zone to TPE. Well screens were placed within the saturated soils and extending up into the unsaturated zone.

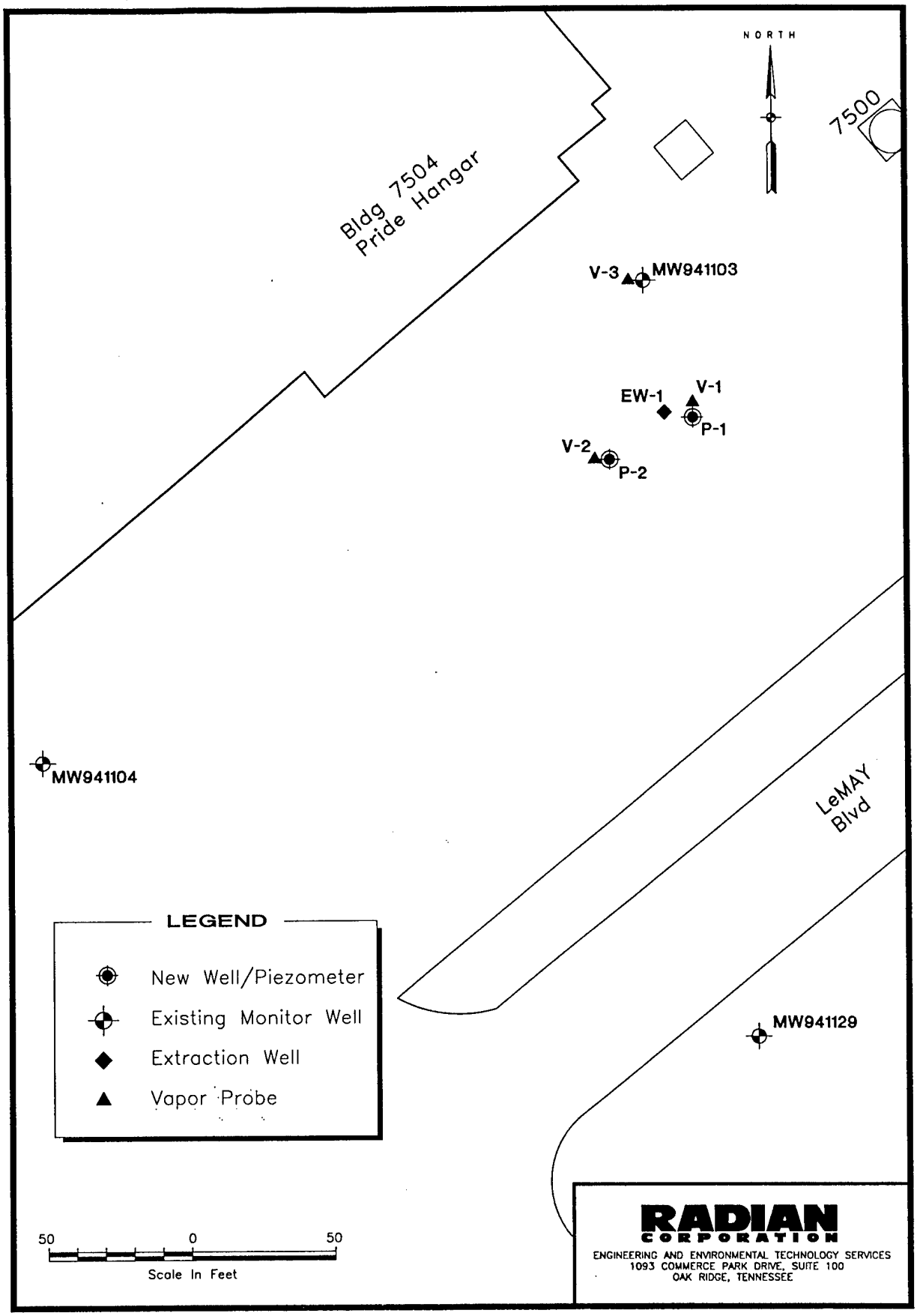

Figure 2-1. Pride Hangar Test Well and Monitoring Points, Ellsworth AFB

Table 2-1

Summary of Wells and Monitoring Point Characteristics

Well/Piezometer ID	Used to Monitor	Total Depth (ft BGS)	Screened Interval (ft BGS)	Approximate Distance from EW-1 (FT)
V-1	Induced Vacuum	16	11-16	10.5
V-2	Induced Vacuum	16	11-16	23.3
V-3	Induced Vacuum	17	12-17	49.4
P-1	Water Level	30	20-30	11.6
P-2	Water Level	30	9-29	21.3
MW 941103	Water Level	23.3	13-23	48.9
EW-1	Extraction Well	33.5	23.5-33.5	

BGS = Below Ground Surface

The piezometers and vapor probes were installed between 10 and 13 May 1996 using a hollow stem auger drilling rig with 6-inch outside diameter augers. Soil samples were collected from selected intervals so that lithologic logs could be prepared and for headspace screening (Appendix A).

The piezometers were constructed with 2-in. diameter polyvinyl chloride (PVC) well casing and screen. The casing, sand pack, and bentonite seal were installed through the augers to ensure the stability of the well bore. The details of the wells are contained in the completion logs in Appendix A. The screen lengths were 10- and 20-foot long screen in piezometers P-1 and P-2, respectively.

After the piezometers were completed, they were developed to remove silt and clay and ensure communication with the aquifer. The wells were first surged with a 2-inch, vented, surged block to loosen up the fine material from the sand pack so that it could be removed. The piezometers were then purged using a disposable bailer. Water quality was monitored during development by visually observing the silt and clay content of the water and by pH and turbidity measurements. Development was judged complete when the pH was stable and turbidity of the water had decreased to the satisfaction of the supervising geologist. Development logs are contained in Appendix A.

Vapor Probes: Three vapor monitoring probes (V-1, V-2, and V-3) were installed in the unsaturated (vadose) zone to measure the induced vacuum. The probes had 5 feet of screen set at approximately 11 to 16 feet BGS. The probes were located at distances of 10.5, 23.3, and 49.4 feet from EW-1. Figure 2-1 shows the locations of the extraction well, piezometers, and vapor probes.

The vapor probes were constructed with 1-inch diameter PVC well casing and screen. The well casing, sand pack, and bentonite seal were installed through the augers to ensure the stability of the well bore. The details of the wells are contained in the completion logs in Appendix A.

2.1.2 Test Equipment

The test was conducted using a trailer-mounted, 25-horsepower, high-vacuum extraction unit capable of producing an air flow rate of 300 actual cubic feet per minute (acfm) at 25 inches of mercury (pump rating on suction side). The system is shown in schematic in Figure 2-2. Extracted groundwater was discharged to temporary storage tanks, and extracted vapor was discharged to the atmosphere.

The wastewater was then transported and discharged to the OU-1 treatment plant. Procedures followed during the testing are summarized in the work plan described in Section 2.0.

2.2 Sampling and Analytical Methodologies

All sampling and analytical procedures (except where noted) were conducted in accordance with procedures and protocols described in the EPA-approved Ellsworth AFB QAPP. Sampling locations and frequency are summarized in Table 2-2.

2.2.1 Sampling Methodology

System parameters and ambient air conditions were measured through various vacuum gauges, meters, and thermometers included on the TPE trailer. Groundwater drawdown in the observation wells was measured using an electronic water level meter, and induced vacuum was measured using Magnehelic® gauges. Data collected were recorded on field data tables (Appendix B).

Baseline groundwater samples from EW-1 were collected prior to TPE testing in 40-milliliter (mL) volatile organic analysis (VOA) vials using a dedicated Teflon® bailer. Prior to collecting the baseline samples, three well volumes of water were purged from the well. Approximately one hour after ending the test, post-test groundwater samples were collected using the dedicated bailer.

Water samples collected during the test were taken directly from the TPE trailer knock-out pot with VOA vials. All VOA vials were iced and stored in a dedicated cooler until shipped to Energy Laboratories, Inc., in Rapid City, South Dakota.

Vapor samples were collected using disposable syringes and evacuated vials provided by Microseeps Inc., Pittsburgh, Pennsylvania. Once the samples were collected, they were stored at ambient conditions until shipped to the Microseeps laboratory for analysis.

Quality control samples were also collected in the field. Duplicate water and vapor samples were collected at a 10% frequency by the methods previously described. Trip blanks accompanied the VOA vials throughout shipping and handling.

2.2.2 Analytical Methodology

Groundwater samples were analyzed for VOCs by EPA Method SW-8260. Soil vapor samples were analyzed for VOCs by Microseeps Analytical Method AM 4.03.

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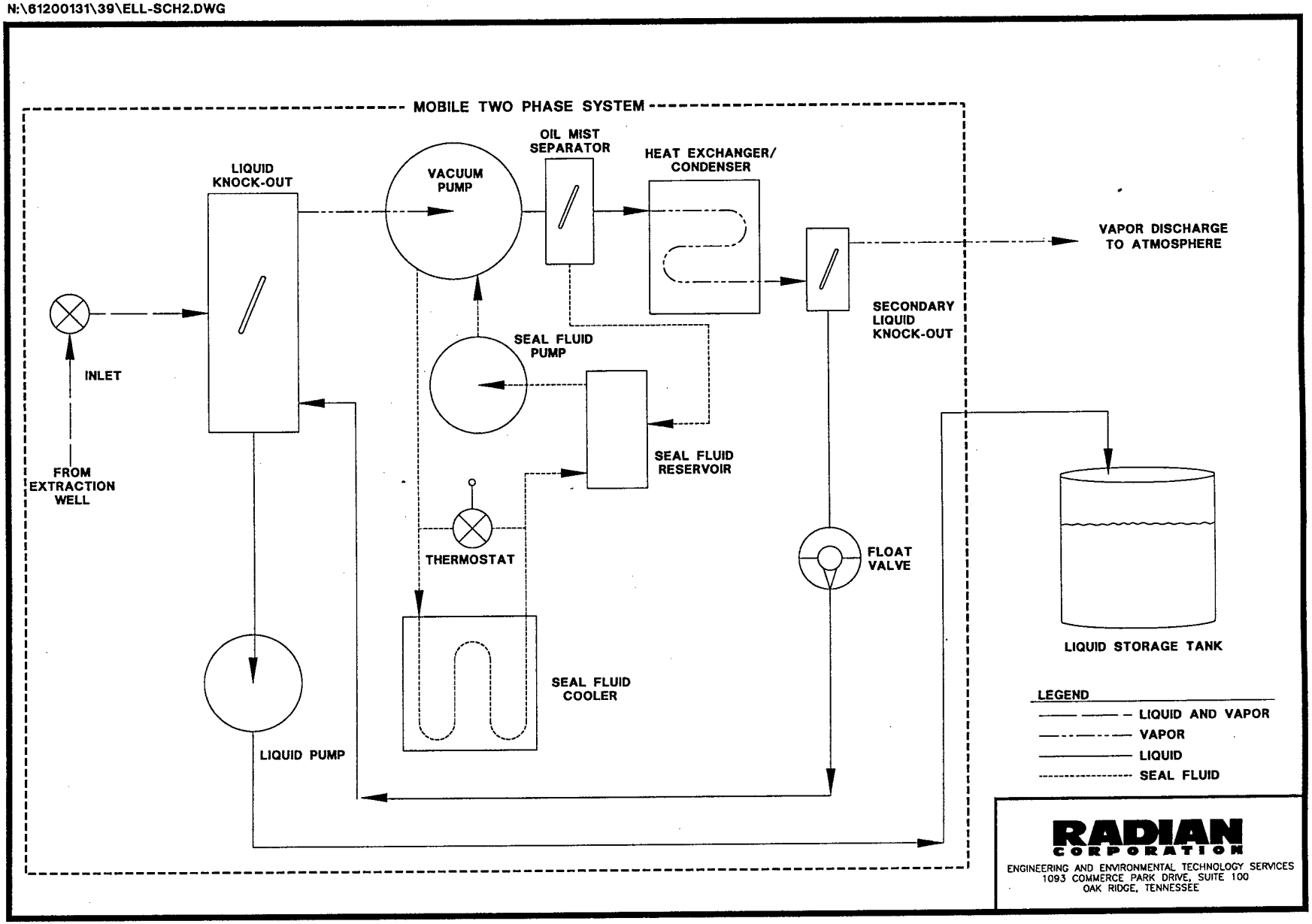


Figure 2-2. TPE System Schematic

Table 2-2

Frequency of Sample Collection and Source Monitoring

Schedule										
Day	Hour	Ambient Barometric Pressure	Ambient Temperature	Measure Water Level at Test Well	Groundwater Sample from Test Well	Water Levels at Groundwater Piezometers	Effluent Vapor Samples	Induced Vacuum at Soil Vapor Monitoring Probes	System Parameters	Water Sample from Knock-Out Pot
0	Before	X	X	X	X	X				
1*	1		X			X		X	X	
1	2		X			X		X	X	X
1	4		X			X		X	X	X
2*	0	X	X			X		X	X	
2	1		X			X	X	X	X	X
2	2.5	X	X			X		X	X	
2	3		X			X		X	X	
2	3.5		X			X		X	X	
2	4.0	X	X			X		X	X	X
3**	0	X	X			X		X	X	
3	0.5					X		X	X	
3	2.0					X	X	X	X	X
3	3.0					X		X	X	
3	3.5					X		X	X	
3	4.0					X		X	X	
3	5.0					X	X	X	X	X
3	6.0					X		X	X	
3	7.0					X		X	X	
3	8.0					X	X	X	X	X
4	3		X	X	X	X	X	X	X	X

Note: Groundwater/water samples analyzed for VOCs by Method SW-8260. Vapor samples analyzed for VOCs by Microseeps Analytical Method AM 4.03.

*Unit was operated for only 4 hours on day one and then restarted and operated for only 4 hours on day two.
**Unit was restarted on day three and operated for 21.5 hours.

3.0 TEST RESULTS AND CONCLUSIONS

A critical step toward adding another presumptive remedy to the PREECA process is to compare that remedial technology's test results, referred to here as the "site-specific profile," to its PREECA Multi Phase Extraction (MPE) remedy profile and determine the extent to which the two profiles match. The remedy profile comprises the performance data (including site selection criteria, process and methodology descriptions, and the acceptable range of quantitative results) by which the effectiveness of the presumptive remedy will be judged.

Radian performed a three-day test on the EW-1 well. Table 3-1 summarizes the results achieved using the TPE system at the EW-1 well. The results of this test are described in Section 3.4.

Table 3-1

Summary of Results

System Parameter	EW-1
Groundwater Extraction Rate	15 gpm
Soil Vapor Extraction Rate	0-2.5 scfm
Contaminant Removal Rate	0.04 lb/day
Radius of Influence (Groundwater)	>100 ft

gpm = gallons per minute
scfm = standard cubic feet per minute

Based on the results of the pilot-scale TPE test conducted at Ellsworth AFB Pride Hangar, Radian has constructed a site-specific profile for the Pride Hangar. A comparison of this site-specific profile to the PREECA's MPE remedies profile are presented in Tables 3-2 and 3-3. Note that the Pride Hangar profile compares favorably with the corresponding MPE remedy profiles for the dual-phase extraction remedies. However, this site does not fit within the TPE remedy guideline. The high groundwater production rate does not match the TPE criterion. However, the lithology present may indicate moderate permeability soil that may be suitable for LVDPE.

3.1 System Operation

Physical and analytical data were analyzed to determine the following:

- Baseline VOC concentrations in groundwater;
- The major VOC constituents in the vapor and water streams;
- Average groundwater and soil vapor extraction rates;
- Average VOC extraction rates and total pounds of VOCs removed;
- The relationship between time and VOC concentrations;
- The relationship between time and vapor and water flow rates; and
- The relationship between distance and groundwater drawdown and induced vacuum, including radii of influence.

3.2 Radii of Influence and Production Rates

The following sections describe groundwater and vapor production rates and radii of influence.

3.2.1 Groundwater

The groundwater flow rate was measured using a totalizing flow water meter and is plotted along with the total vapor flow rate on Figure 3-1. Water table drawdown was measured in piezometers P-1, P-2, and MW941103 (Appendix B). A plot of drawdown versus time is presented in Figure 3-2 and maximum drawdown versus distance for the EW-1 test is presented in Figure 3-3.

Table 3-2

MPE Technology Selection Criteria for the Pride Hangar Site

Criteria Parameter	Pride Hangar Site	Guideline
Contaminant	TCE	Halogenated VOCs, and non-halogenated VOCs & TPH for sites where expedited action is required
Contamination location	saturated zone	Saturated zone alone or saturated & vadose zones combined
Contaminant concentration	97-410 µg/L	Significantly greater than MCLs (the Ellsworth AFB MCL for TCE is 5.0 µg/L)
Henry's Law Constant of majority of contaminants	0.297 at 20 C°	> 0.01 at 20 C° (dimensionless)[1]
Vapor pressure of majority of contaminants	58 mm Hg at 20 C°	> 1.0 mm Hg at 20 C°
Lithology of saturated zone	clayey-gravel and weathered Pierre Shale	Sands to Clays
Depth of contamination in vadose zone (if targeted)	N/A	> 5 feet bgs (MPE not applicable < 5 feet bgs)
Average air permeability of vadose zone (if targeted)	N/A	Low permeability (< 1 x 10^{-3}) and moderate permeability (between 1 x 10^{-3} darcy and 0.1 darcy) soils.

1 Dimensionless Henry's Law Constant in the form: (concentration in gas phase) / (concentration in liquid phase)

Table 3-3

LVDPE, HVDPE, and TPE Technology Selection Criteria for the Pride Hangar Site

Criteria Parameter	Pride Hangar Site	LVDPE Guideline	HVDPE Guideline	TPE Guideline
Groundwater production rate[1]	15 gpm (under vacuum)	> 2 gpm[2]	No limitations	< 5 gpm
Depth of targeted contamination	> 25 feet bgs	No limitations	No limitations	Up to 50 bgs ± (for groundwater production < 2 gpm) Up to 20-30 bgs (for groundwater production = 5 gpm)
Lithology of saturated zone	Clayey gravel	Sands to silty sands	Sandy silts to clays	Sandy silts to clays
Average air permeability of vadose zone (if targeted)	N/A – not targeted	Moderate permeability (greater than 1 x 10^{-3} darcy)	Low permeability (less than 1 x 10^{-2} darcy)	Low permeability (less than 1 x 10^{-2} darcy)

1 For MPE, the aquifer must be able to be dewatered.
2 For flows < 2 gpm, pneumatic pumps may be used in place of submersible pumps

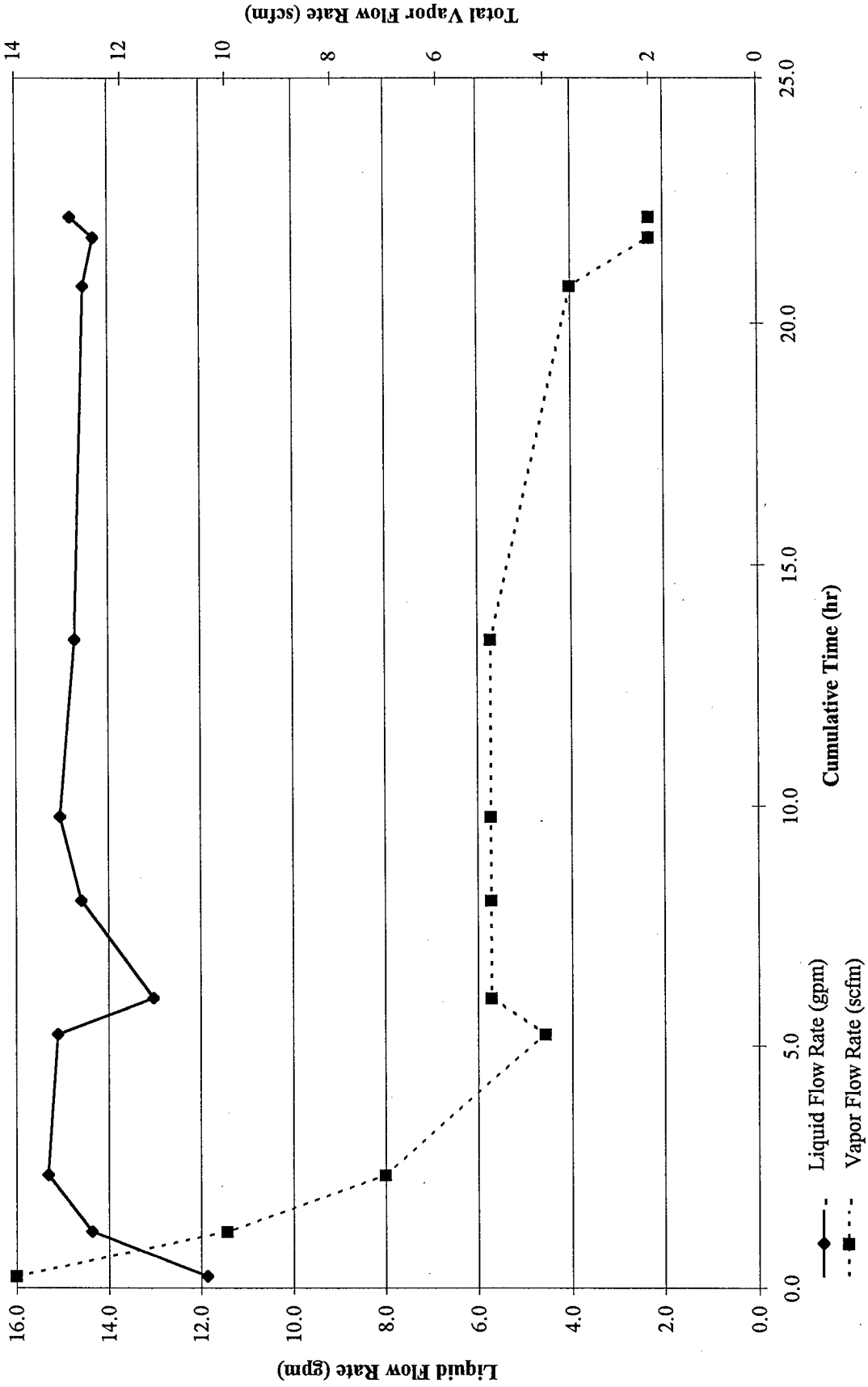


Figure 3.1 Liquid and Total Vapor Flow Rates (PRIDE HANGAR SITE)

Figure 3.2 Water Level Drawdown Over Time (PRIDE HANGAR SITE)

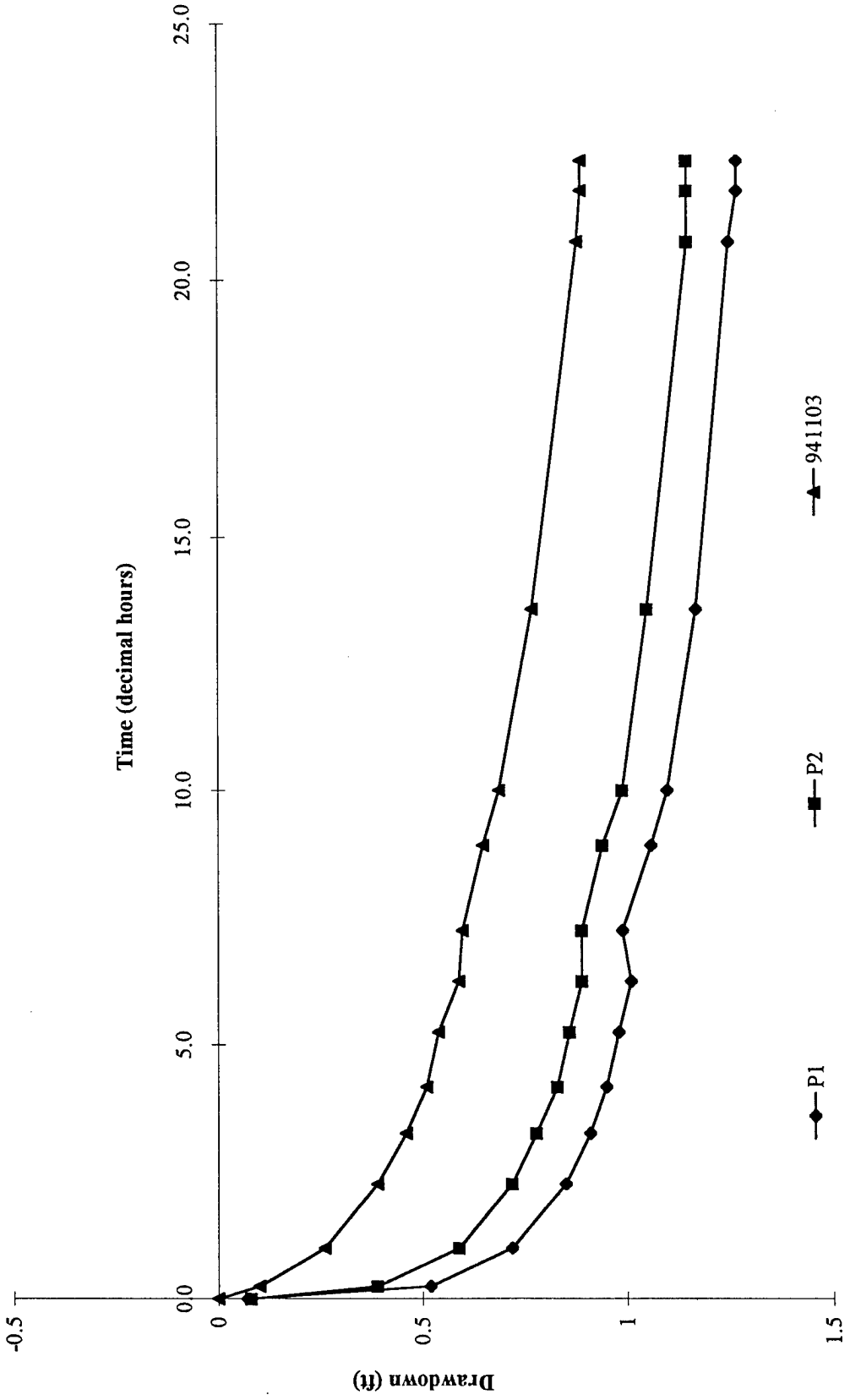
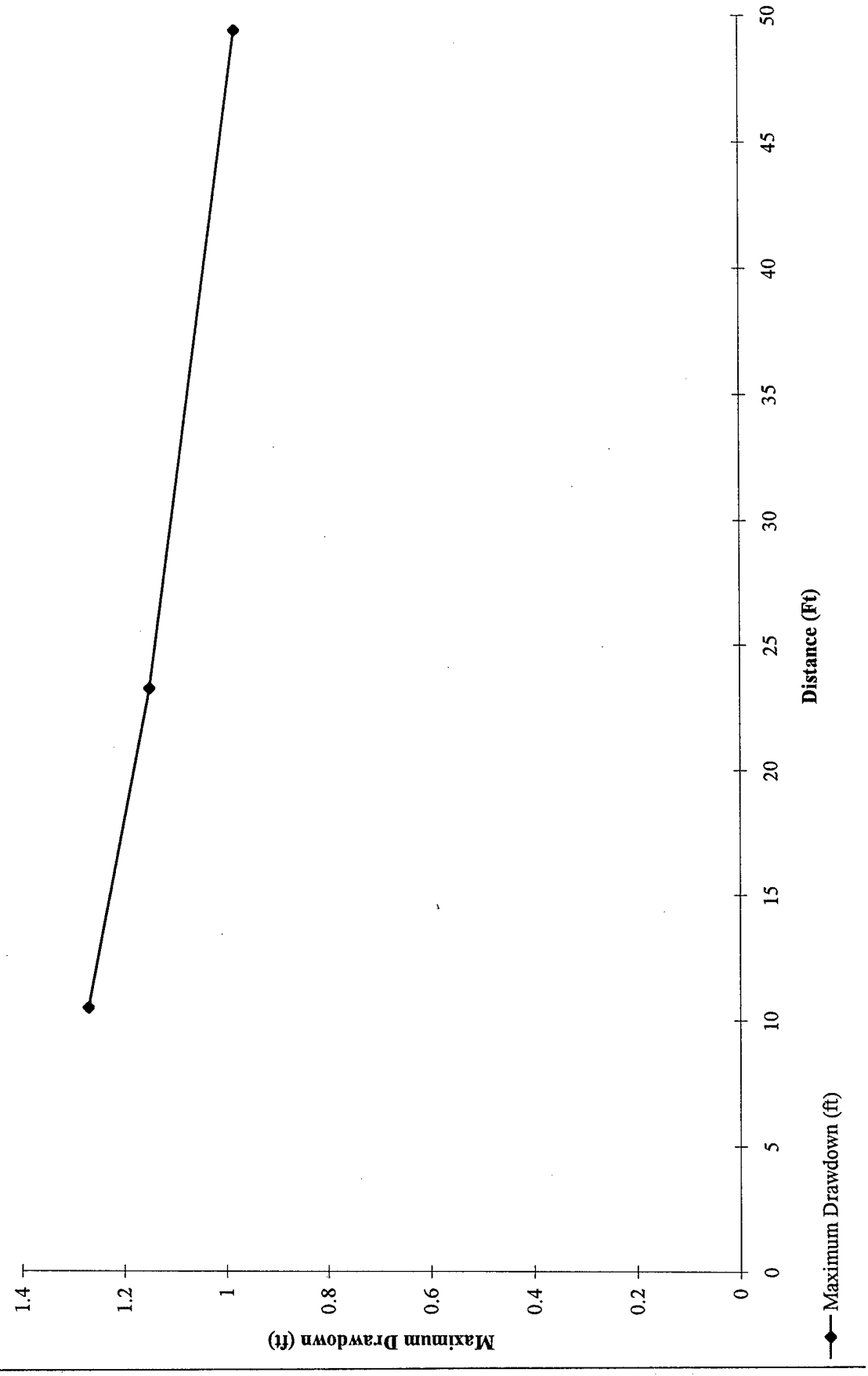


Figure 3-3. Maximum Drawdown Vs. Distance For The Pride Hangar Test



Because of water handling limitations, the TPE testing was of several short duration periods from 2 to 22 hours in length. During the longest test (22 hours), the groundwater flow rate fluctuated in the range of 14 to 16 gallons per minute (gpm) over most of the test period. Water levels in the piezometers dropped steadily over the length of the test and it is unlikely that steady state conditions were reached. The hydraulic radius of influence (defined as 0.1 feet of drawdown) is estimated to be 7100 feet based on available data. The short duration of the test, prevented an accurate estimate.

3.2.2 Vapor

The total vapor flow rate was measured using rotameters located at the skid and is plotted along with the water flow rate on Figure 3-1 for the Pride Hanger test. Induced vacuum was measured in piezometers P-1, P-2, and MW941103 and in vapor probes V-1, V-2, and V-3 (Appendix B). Figure 3-4 shows the maximum induced vacuum influence for the test.

3.3 VOC Recovery

Tables 3-4 and 3-5 summarize analytical results for the VOCs detected in the samples collected during the test. TCE was the primary contaminant found at the site (see Appendices C and D for the analytical laboratory results and chain-of-custody forms). Results of VOC sampling at EW-1 included:

- The baseline concentration (before the test) of chlorinated VOCs (TCE) in groundwater from EW-1 was 97 micrograms per liter (µg/L).
- The post-test concentration of chlorinated VOCs (TCE) was 410 µg/L. It is likely that a higher concentration area of the plume was pulled toward EW-1 as a result of the TPE.
- The chlorinated VOC (TCE) concentration in the extracted water (collected from knock-out pot) averaged 60 µg/L in the EW-1 test.
- The total VOC (TCE) concentration in extracted vapor increased throughout the EW-1 test, beginning at 0.5 ppmv and ending at 23.7 ppmv.

3.3.1 Extraction Results

Results of the Pride Hangar test included:

- Approximately 0.03 pounds of total VOCs were extracted from EW-1 in this short duration test. The majority of the compounds were extracted in the vapor phase.
- Average groundwater extraction rate was 15 gpm.
- Vapor extraction rate from the formation was 0-2.5 standard cubic feet per minute (scfm). Total system flow was 2-14 scfm.
- The TPE extraction system transferred approximately 80% of the VOCs in the groundwater to the vapor phase based on data near the end of the test, resulting in decreased concentrations in the water phase and reduced treatment cost.

3.3.2 VOC Removal Over Time

The graph showing total VOC removal over time at the test well is provided in Figure 3-5. Concentrations in extracted vapor increased during the test. Average off-gas vapor and effluent water concentrations for the EW-1 test were:

- 7.73 ppmv VOCs in extracted vapor and
- 60 µg/L VOCs in extracted groundwater.

Figure 3-4. Maximum Induced Vacuum For The Pride Hangar Test

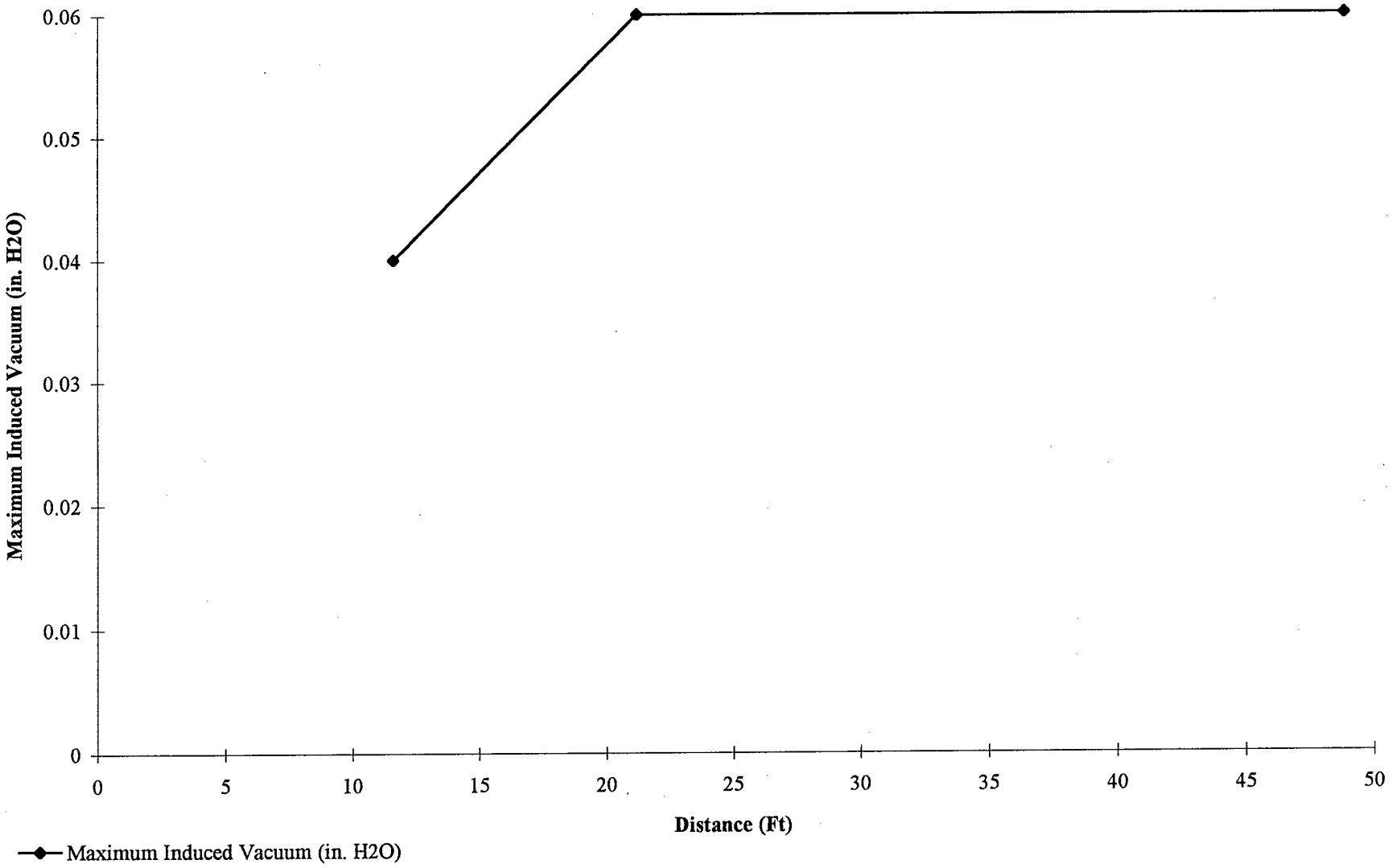


Table 3-4

Summary of Water Data
Concentration in Micrograms per Liter (µg/L)

	Contaminant[a]			
Sample ID	Chloroform	cis-1,2-Dichloroethylene	Trichloroethylene	Methyl Ethyl Ketone
EW-1 Pre-Test	—	—	97	—
Effluent 1	2.6	1.4	77	—
Effluent 2	—	—	37	—
Effluent 3	—	—	56	—
Effluent 4	—	—	34	—
Effluent 5	—	—	78	—
Effluent 6	—	1.4	78	—
EW-1 Post-Test	—	3.3	410	50
EW-1 Post Test (Dup)	—	2.5	390	2.5

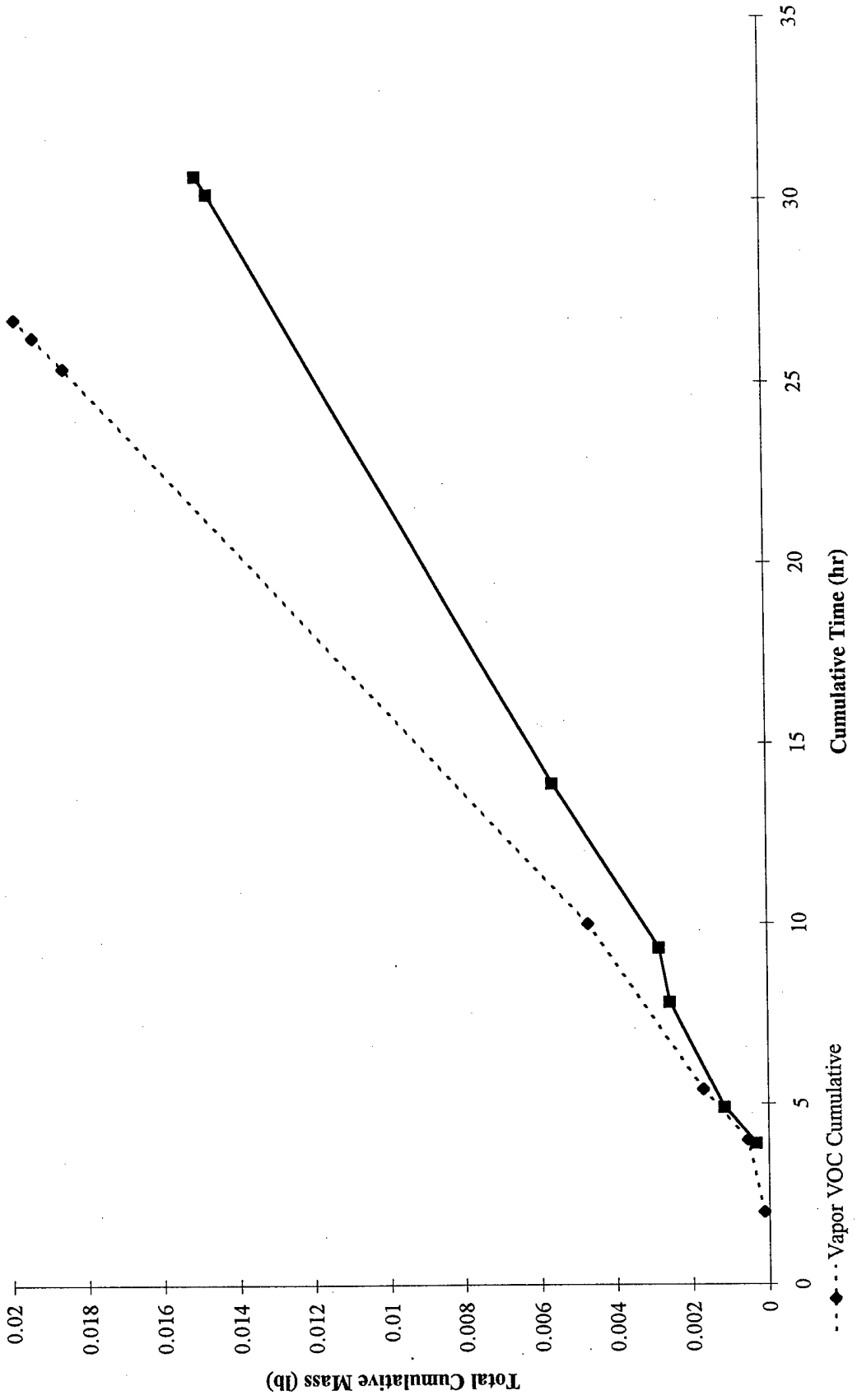
[a]Only analytes with confirmed hits above detection limits are reported.
Note: All influent samples were taken from the knock-out pot prior to carbon treatment.

Table 3-5

Summary of Vapor Data
Concentrations in Parts per Million by Volume (ppmv)

	Extracted Vapor Concentration				
Sample ID	Toluene	Trichloroethylene	Tetrachloroethylene	1,1-Dichloroethane	Chloroform
V1	0.12	0.401	0.013	0.013	—
V2	—	1.72	—	—	—
V3	—	3.802	—	—	—
V4	—	6.011	—	—	—
V5	—	11.09	—	0.12	0.005
V6	0.09	23.365	0.006	0.23	0.009
V6 (Duplicate)	0.08	22.170	0.005	0.23	0.009

Figure 3-5. Total Mass of VOCs Removed Over Time (water and vapor)



Fifty-four percent of the total VOCs removed were from the vapor phase and the remaining 46% were in the water phase.

3.4 Conclusions

3.4.1 Hydrogeologic Conclusions

An average flow rate of approximately 15 gpm at a drawdown of 10 feet at EW-1 was achieved during the TPE test. Well EW-1 has a 10-foot screen that was open within the saturated zone in the alluvial sediments and weathered fractured shale (see Figure 1-2). During the test, approximately 7 feet of the screen was exposed for vapor flow.

The saturated zone consists of a heterogeneous mixture of low permeability weathered and fractured shale (estimated hydraulic conductivity of 9.5×10^{-6} cm/s) (EA, 1995) and higher permeability clayey-sand and gravel. A slug test performed by Rust after the completion of the test indicated that the combined zone had a hydraulic conductivity of 1.4×10^{-2} cm/s. Typical hydraulic conductivities for the saturated zone at Ellsworth AFB (as in EW-1, most wells tested were a combination of alluvial materials and weathered shale) range between 10^{-5} and 10^{-3} cm/s. EW-1 is clearly an outlier with a hydraulic conductivity of 10^{-2} cm/s.

Because of water handling limitations, it is uncertain whether dewatering of the aquifer would have occurred over time and if well flow rates would as is typically seen at TPE sites.

Sustained yield is a function of the hydraulic conductivity, saturated thickness, recharge, and the variability of these properties around the pumping well. In some cases at Ellsworth AFB, well yields in similar higher conductivity materials were substantially lower than for EW-1. The more likely scenario is that higher conductivity materials are probably laterally more extensive in the Pride Hanger area.

3.4.2 Technology Evaluation

The TPE test on EW-1 at the Pride Hangar was conducted for 32 hours on 13-16 May 1996. Radian operated the extraction system for 4.5 hours on 13 May and four hours on 14 May to make appropriate adjustments to the equipment in order to operate continuously starting on 15 May 1996. Extracted groundwater was stored in large tanks on site and transported to the OU-1 treatment facility for final treatment. After 22.5 hours of continuous operation on 15-16 May, all available water storage capacity was full and the test had to be shut down.

Drawdown of approximately one ft was obtained at a radius of 50 feet in less than 24 hours. Because of the short duration of the test, ultimate radius of influence could not be determined, but the data suggested that it may be significantly greater than 100 feet.

Approximately 26,000 gallons of VOC (primarily TCE)-contaminated water were removed during the test operations between 13 May and 16 May 1996. Roughly 80% of the VOCs contained in the groundwater was stripped, based on data near the end of the test.

Whereas removal from the saturated zone was good, the conditions at this site would result in TPE being relatively ineffective at simultaneously removing volatile contaminants from the vadose zone (although significant vadose zone contamination was not present at this site). This site yielded a high water flow rate (15 gpm), because of the productive saturated zone. Yet it yielded a low vapor flow rate from the formation (0-2.5 scfm) because of the tighter vadose zone, and also because most of the vacuum energy was used to move the water. A higher vapor flow rate and higher formation vacuum would be needed to remove vadose zone contamination effectively.

This test was performed during a wet period and at a time when the seasonal water table is typically high. Even with operation over a longer time it is not known whether a larger area

would be dewatered such that water yield would decrease and dry out the sediments so that vapor flow would increase. In the 1995 Technical Evaluation Report for the OU-1 Two-Phase Extractors test, it was stated that TPE was applicable up to flows of 15 gpm. Because of this test, it was shown that TPE does not perform well at high flow rates with the present pilot test equipment configuration. Another configuration such as LVDPE or HVDPE may provide greater mass removal rates in highly productive formations.

4.0 ELLSWORTH AFB REMEDIAL ACTION ENHANCEMENT

The test at the Pride Hangar site revealed several important pieces of information:

- This is a productive aquifer compared with other locations on the Base that have been pumped.
- Groundwater was seasonally high and rising during the test. This likely resulted in a higher groundwater flow than would be obtained during a drier part of the year.
- Sampling conducted two years ago by EA indicated a concentration of 7,000 micrograms per liter (µg/L) TCE. Sampling following this test indicated only 410 µg/L. It is possible that the plume has migrated and/or dispersed significantly in this productive aquifer.
- Pre-test sampling on EW-1 indicated only 97 µg/L TCE, whereas post-test sampling indicated 410 µg/L, as stated above. This further suggests that the plume may have migrated and that the aggressive nature of the TPE process pulled the plume toward the well.
- Even though this was the area of highest concentration in the 1994 sampling, no vadose zone contamination was detected. This does not appear to be the source area for the plume.
- Although the TPE process would likely be effective if aggressive hydraulic control were desired, it is not likely the most cost effective technology for remediation of this plume.

It is recommended that another round of groundwater sampling of the existing well network be conducted in the area, particularly to the south and southeast of the Pride Hangar. This would show the extent of migration of this plume since the 1994 investigation. It was suspected that a solvent tank at the northwest corner and/or a fuel oil tank on the south side of the Pride Hangar were sources of this plume and that it had migrated to the southeast corner in 1994. It may have continued to migrate since then.

Also, additional aquifer tests would give a better picture of the aquifer characteristics. This would be essential in the design of a groundwater control or remediation system in this area. This is particularly important since EW-1 appears to be one of the most productive wells on the Base.

It is likely that pump and treat would be the most cost-effective remedial technology at this site. Significant groundwater is expected from the fermution flow with conventional pumping, although it is likely to be less than the groundwater extraction rate expected with TPE. Considering the location of this plume in the middle of the Base, aggressive hydraulic control is probably not warranted. If the source area can be located with significant vadose zone contamination and/or DNAPL (dense, non-aqueous phase liquid), then a hot spot removal action with MPE may be appropriate.

5.0 REFERENCES

EA Engineering and Science, Inc., 1995. *Remedial Investigation Report, Operable Unit 11 at Ellsworth AFB, South Dakota,* September.

Radian Corporation, 1996. *Ellsworth AFB 2-Phase™ Vacuum Extraction Pilot-Scale Test Work Plan, Ellsworth AFB, South Dakota*, May.

U.S. Air Force, 1995. *United States Air Force Presumptive Remedy Engineering Evaluation/ Cost Analysis (PREECA),* Final, 5 May.

APPENDIX A

Well Drilling and Development Logs

SINGLE COMPLETION WELL CONSTRUCTION LOG

5/11/96

Well Number Pride Hangar EW-1

Project Elksworth 2-Phase

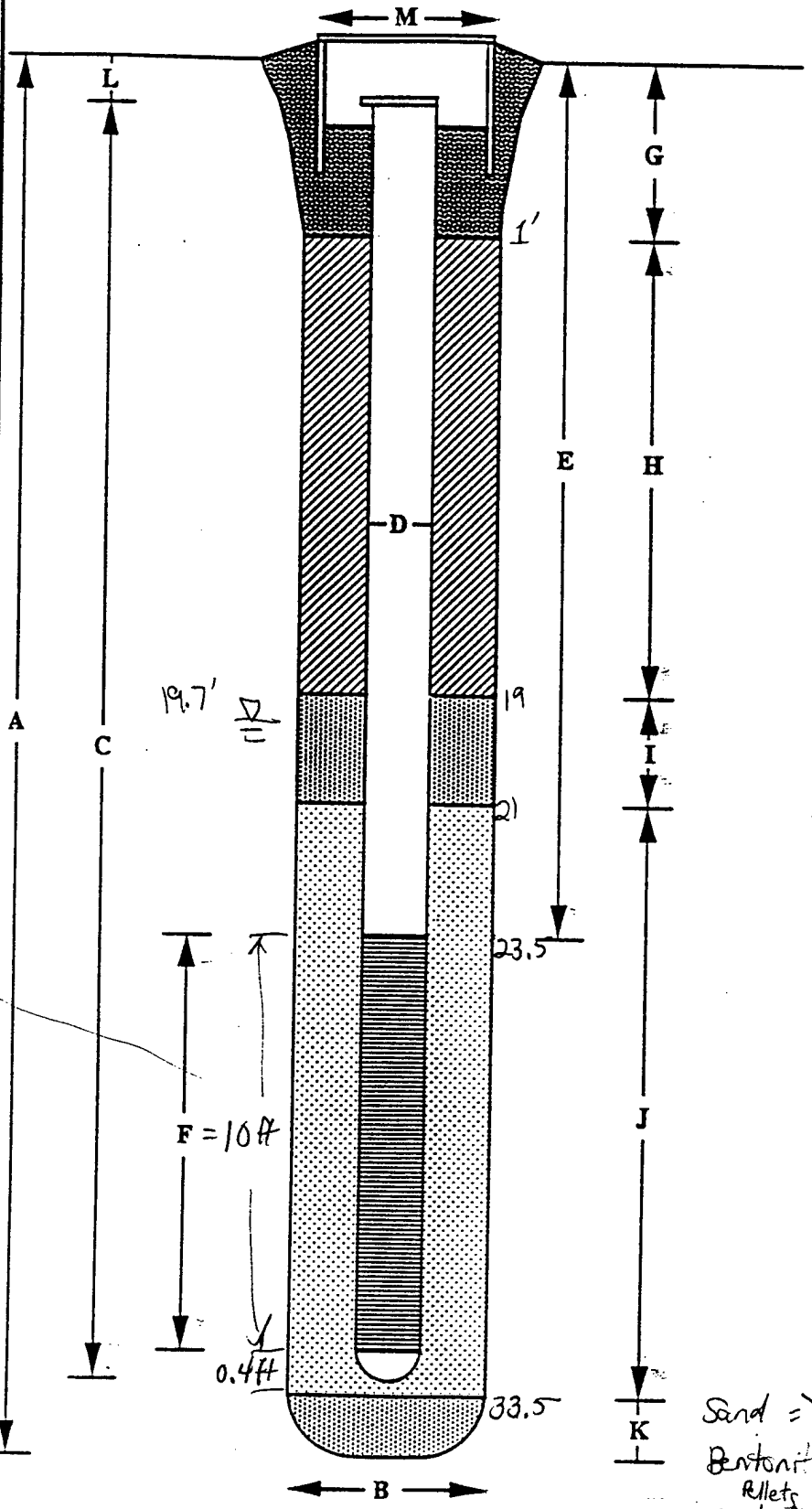
Project Number 612-001-31-30

Location Pride Hangar

Datum

Top of Casing Elevation

Ground Surface Elevation



BORING

A. Total Depth (ft) 35'

B. Boring Diameter (in.) 11"

Drilling Method HSA

WELL CONSTRUCTION

C. Casing Length (ft)

Type Sch. 40 PVC

D. Casing Diameter (ft) 4"

E. Depth to Top of Slotted Interval (ft) 23.5

F. Perforated Casing Length (ft) 10 ft

Perforated Interval From 23.5 to 33.5 ft

Perforation Type Continuous Wrap PVC

Perforation Size 0.010

G. Surface Grout Interval (ft) 0-19

Grout Material Dacotah Type I/II Portland Cement

H. Backfilled Interval (ft) NA

Backfill Material NA

I. Sealed Interval (ft) 19-21

Seal Material Volclay Pure Gold 3/8" Bentonite Pellets

J. Filter Pack Interval (ft) 21-33.5

Pack Material 10/20 Silica Sand

K. Bottom Seal Interval (ft) Bottom Cap. PVC

Seal Material Bottom cap 0.4'

L. Depth to Top of Casing (in)

M. Protective Casing Diameter (in) 12"

Sand = ~~IIII~~ IIII

Bentonite = 2 buckets Pellets

Bent. Chips 1 bag

A-1

19.1 20.2 19.7 20.5

DRILLING LOG

HOLE NO. EW-1

1. COMPANY NAME: Radian	2. DRILLING SUBCONTRACTOR: Maxim
3. PROJECT: Ellsworth 2-Phase	4. LOCATION: Pride Hanger
5. NAME OF DRILLER: Brent Thomas	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 75
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 6¼" ID HSA; 10¾" OD; 5' Split Spoon core sampler	8. HOLE LOCATION
	9. SURFACE ELEVATION
	10. DATE STARTED: 5/10/96 — 11. DATE COMPLETED: 5/11/96
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: 5 ft into weathered Shale	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 35 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
2-Phase extraction Well			Extraction Well	Karen M Masters

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (PID) d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
Asphalt	Top	0. Asphalt pavement	SS = 0 ppm				9:10 Spud (cutting asphalt)
GM	1	0-1.4 – Fill gravel with fine to med. silty sand poorly sorted, sub-ang to subround. 7.5 YR 4/3					
	2		HS = 2.8			3.7'	Rec. 3.7
	3	brown, damp, loose					BZ = 4 ppm
CL	4	1.4-3.7 Plastic clay w/ black staining very dark grayish brown 2.5 Y 3/2, white calcareous lime nodules/specks	HS = 673 ppm				AA = 0.4 ppm
	5						
	6	0-2.4 Clay as above	HS = 392 ppm @ 7.5				AA = 0.4
	7					5'	BH = 160 ppm
	8						BZ = 0.4 ppm
SC-GC	9	2.4-5 Clayey fine sand, ~~well~~ poorly sorted w/ gravel to ~8.5 Ft, then well sorted. Damp, med. dense brown 10 YR 5/3	HS = 4 ppm				SS = 1.0 ppm
	10						Background Hdsp. in van 2.0 ppm

PROJECT

HOLE NO.

DRILLING LOG — Pride Hangar

HOLE NO. FW-1

PROJECT

INSPECTOR

SHEET OF 2 SHEETS 3

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
SC-GC	10	0-1.4' Clayey sand as above with pebbles up to 4" across, (rounded) very coarse pebbly zones at about 10-10.4' and 11-11.4' Fe staining. Very poorly sorted, damp, med. dense	SS = 1 ppm			1.4'	Difficulty Drilling Sounds like a rock. Large cobbles
	11						
	12						
CH	13						Background Hdsp. in van 2 ppm
	14		HS = 7 ppm				
	15						
	16	0-5 Plastic Clay with white calc. deposits Cobbles in top 0.3 ft. The rest is homogeneous fat clay	HS = 4.5 ppm			5'	AA = 1 ppm
	17		HS = 2.5 ppm				BZ = 2 ppm
	18						
	19			in well ▽ 11			
	20						
SC	21	0-2.4 Sandy clay with cobbles. Sat. at about 22.5' Rounded cobbles, iron staining soft Cobbles up to 4" across brown 7.5 YR 5/3		Approx. during drilling 22.5 ▽ 11		2.4'	Driller says water at ~22.5'
	22		HS = 30 ppm				SS = 1 ppm
	23						11:30 am stopped drilling - Need to repair rig
	24						
	25	2-3 Saturated clayey fine to coarse sand with gravel to cobbles loose, poorly sorted					2:30 Resumed drilling
SC-GC	26					1.3	
CH	27	3-1.3 Plastic clay Fe stained + some minor black staining	HS = 7 ppm				
	28						

PROJECT

HOLE NO.

OVER

EW-1 Sheet 3 of 3

	Description	Field Screening	Rec.	Remarks
29	Clay & 10 YR 5/4	HS		
30				
31	Weathered Pierre Shale	2. No sample	0	No recovery. Large Cobblestone at base of augers. Observed weathered Pierre Shale smeared core barrel
32				
33				
34				
35	END BORING AT 35'			
36				
37				
38				
39				
40				

SINGLE COMPLETION WELL CONSTRUCTION LOG

Well Number Pride Hangar P-1

Project 2-Phase 1 5/11/96

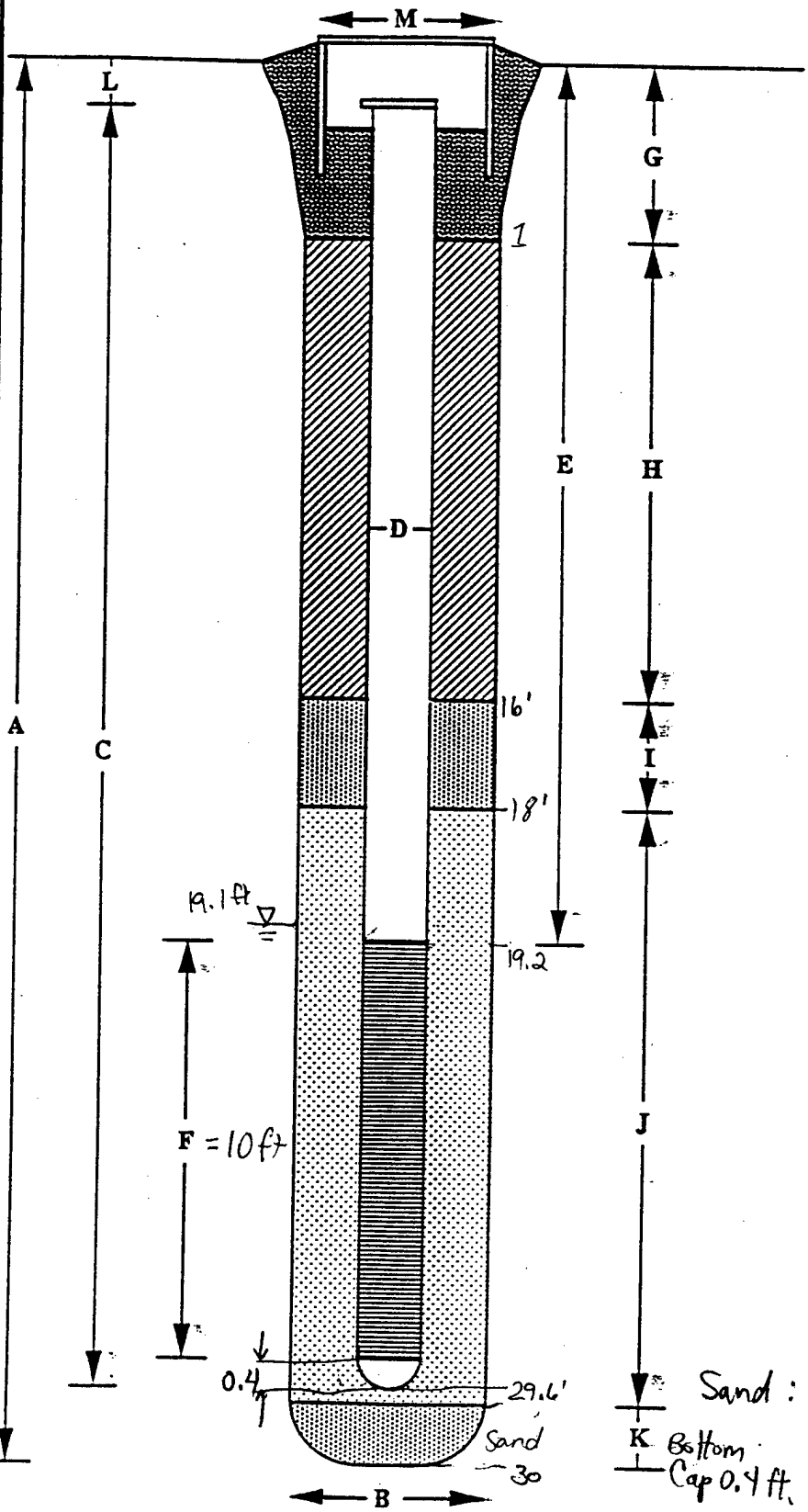
Project Number 612-001-31-30

Location Pride Hangar

Datum

Top of Casing Elevation

Ground Surface Elevation



3¾ ID Boring

BORING

A. Total Depth (ft) 30 ft

B. Boring Diameter (in.) 6½ OD

Drilling Method HSA

WELL CONSTRUCTION

C. Casing Length (ft)

Type 10 Slot PVC / Blank Sch 40 PVC

D. Casing Diameter (ft) 2"

E. Depth to Top of Slotted Interval (ft) 20'

F. Perforated Casing Length (ft) 10 ft

Perforated Interval From 20 to 30 ft

Perforation Type Factory Slotted Sch 40 PVC

Perforation Size 10 Slot

G. Surface Grout Interval (ft) Surface – 14'

Grout Material Dacotah Type I/II Portland Cement

H. Backfilled Interval (ft) NA

Backfill Material NA

I. Sealed Interval (ft) 16 – 18'

Seal Material Bentonite Pellets

J. Filter Pack Interval (ft) 18 – 30 ft

Pack Material Colo Silica Sand 10-20

K. Bottom Seal Interval (ft)

Seal Material Bottom Cap = 0.4 ft

L. Depth to Top of Casing (in)

M. Protective Casing Diameter (in) 12"

Sand : 1¼ bags

Bent. Pellets - 1 buckets

Tagged Bottom at 29.3

DRILLING LOG

HOLE NO. P-1

1. COMPANY NAME: Radian	2. DRILLING SUBCONTRACTOR: Maxim
3. PROJECT: Ellsworth 2-Phase	4. LOCATION: Pride Hangar
5. NAME OF DRILLER: Brent Thomas	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 75
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3 3/4" ID, 1.5" OD Augers; 5' core sampler; HSA	8. HOLE LOCATION
	9. SURFACE ELEVATION
	10. DATE STARTED: 5/10/96 — 11. DATE COMPLETED: 5/11/96
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: 5 ft into Shale	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 30 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Piezometer	—	Piez	—	Karen M. Masata

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
Asphalt		Asphalt					
Fill + Clayey Sand	1	0-0.4 Gravel fill (angular) with clayey coarse sand subang. Poorly sorted Moist. 5 YR 6/6 Reddish yellow	SS = 2 ppm			2'	Spud 16:30 5/10/96
GC	2	0.4-1.2 Gravelly clayey med to coarse sand, p. sorted, moist brown, 7.5 YR 4/3	HS = 10 ppm				AA = 1 ppm
GC	3						
CH	4	1.2-2.0 Fat Clay, white calc. inclusions, homogeneous, soft, damp, brown 10 YR 4/3					
SC	5	0.-0.6 Fat clay	SS = 1 ppm			5'	
	6	0.6-4.5 Clayey fine sand, well sorted, homogeneous, (plastic clay) subang to subround damp, soft brown 10 YR 4/3					
	7		HS = 0 ppm				
	8	4.5-5 Clayey fine to med sand with gravel, poorly sorted, damp, soft/med. dense					
	9	Some large rounded cobble- up to 3" across brown 10 YR 4/3					
SC-GC	10						

PROJECT

HOLE NO.

DRILLING LOG Pride Hangar

HOLE NO. P-1

PROJECT | INSPECTOR | SHEET 2 OF 2 SHEETS

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
SM	10–15	0–0.7 as above gravelly fine to med clayey sand 0.7–1.1 Fine to med. sand with gravel + cobbles poorly sorted, dry, loose strong brown 7.5YR 5/6	SS HS: 0 ppm			1.1	BZ = 1 ppm
SC CH	15–20	0–0.6 as above 0.6–1.2 fine to very coarse clayey sand, poorly sorted, dry to damp, subrounded dark yellowish brown 10YR 4/4 1.2–3.7 Fat clay with white gale deposits. damp soft dark grayish brown 10YR 4/2 3.7–4.3 fine clayey sand / sandy clay well sorted, some Fe staining 10YR 5/4 yellowish brown	HS = 0.4 ppm	▽ approx		4.3	AA = 0.4 ppm Stopped at 5:30 pm
SC	20–25	0–1.8 Clayey fine sand well sorted, saturated, med. dense., Yellowish brown 10YR 5/4 Becomes coarser from 1.4–1.8 with minor gravel	HS = 0.4 ppm			1.8	5/11/96 7:30 am Resumed drilling 8:00 Stopped drilling – sheared drive shaft pin again.
	25–28	0–3 Weathered Pierre Shale Fe staining, crumbly, damp, Dark Bluish gray 2.5Gy 3/1.	HS = 0			3	Resumed drilling at 10:45 am

PROJECT | HOLE NO.

30'

END BORING 11:15 am

SINGLE COMPLETION WELL CONSTRUCTION LOG

5/12 b/o

Well Number Pride Hangar D-2

Project Ellsworth 2-Phase

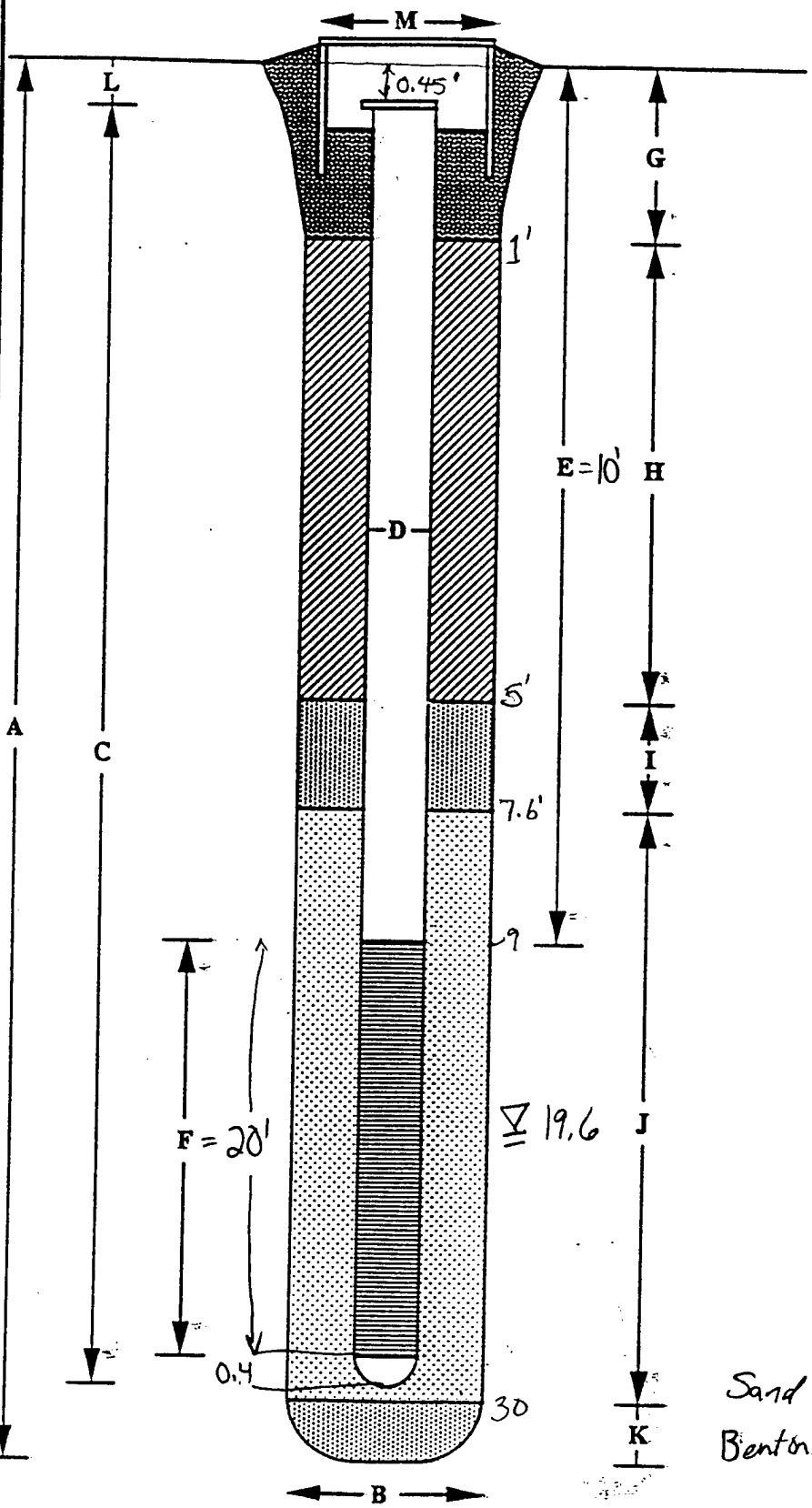
Project Number 612-001-31-30

Location Pride Hangar

Datum

Top of Casing Elevation

Ground Surface Elevation



BORING

A. Total Depth (ft) 30

B. Boring Diameter (in.) 6 3/4"

Drilling Method HSA

WELL CONSTRUCTION

C. Casing Length (ft) 30

Type Sch 40 PVC

D. Casing Diameter (ft) 2"

E. Depth to Top of Slotted Interval (ft) 9

F. Perforated Casing Length (ft) 20

Perforated Interval From 9 to 29 ft

Perforation Type Slotted screen

Perforation Size 10 slot

G. Surface Grout Interval (ft) 1 to 5

Grout Material Dacotah Type I/II Portland Cement

H. Backfilled Interval (ft)

Backfill Material

I. Sealed Interval (ft)

Seal Material Volclay PureGold 3/8" Bentonite Pellets

J. Filter Pack Interval (ft) 7.6 - 30

Pack Material Colo. Silica Sand 10-20

K. Bottom Seal Interval (ft)

Seal Material Bottom Cap 0.4'

L. Depth to Top of Casing (in)

M. Protective Casing Diameter (in) 12"

Sand: 1

Bentonite: 1 bucket

DRILLING LOG Pride Hangar

HOLE NO. P-2

1. COMPANY NAME: Radian	2. DRILLING SUBCONTRACTOR: Maxim
3. PROJECT: 2-Phase	4. LOCATION: Pride Hangar
5. NAME OF DRILLER: Brent Thomas	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 75
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3 3/4" ID } Augers; 6 1/2" OD }; 5' core sampler; HSA	8. HOLE LOCATION: Pride Hangar
	9. SURFACE ELEVATION:
	10. DATE STARTED: 5/11/96 — 11. DATE COMPLETED: 5/11/96
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK: 4 ft into weathered Shale	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 30 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

SHEET 1 OF 2 SHEETS

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Piezometer	—	Piez.	—	Laura M. Masters

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
Asphalt	0	Asphalt & gravel fill 0-1 ft				1 ft.	Spud 16:15
GC	1–5	Coarse gravelly sand fill with some clay poorly sorted, moist, angular to subrounded, loose, light red 10R 6/6	HS=1.2				BZ=1 ppm; BA = 0.4 ppm
SC	6–8	0-3.8 Fine clayey sandy clay, damp, med dense, well sorted, brown 10YR 4/3	HS=2.1			5 ft	
		3.8-5.0 as above, but with gravel/cobbles, yellowish brown 10YR 5/4		in augers ▽ =			
SC-GC	9–10		HS=1				

PROJECT — HOLE NO.

DRILLING LOG

HOLE NO. P-2

PROJECT Ellsworth 2-Phase: Pride Hangar | INSPECTOR Karen Maeda | SHEET OF 2 SHEETS 2

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
SC-GC	10	0-1 Gravelly clayey sand, poorly sorted, with cobbles subang to subround sand, loose, wet brown 7.5 YR 4/3	HS=1 ppm			1.3	AA=1 ppm
	11						
	12						
	13	1-1.3 as above, but very dark brown 7.5 YR 2.5/3					
	14						
	15						
CH	16	0-0.2 as above	HS=0.4 ppm			5	
	17	0.2-3.7 Fat Clay with white calc nodules, homogeneous, damp to wet soft, light olive brown 2.5 Y 5/3					
	18						
SC	19	3.7-5 fine Sandy clay, homogeneous, damp, soft, brown 7.5 YR 5/3 iron staining	HS=0.4 ppm	Approx in well ▽			
	20						
	21	0-2.0 sandy clay/clayey sand as above, iron staining	HS=0.4 ppm	▽ approx. on SS		3	
	22						
SC-GC	23	2-3 Clayey sandy gravel sand is fine to coarse, subang to subround Gravel/cobble is subrounded, loose, saturated yellowish brown 10 YR 5/6					
	24		HS=0.4 ppm				
	25						
Shale	26	0-1 clayey sandy gravel as above	HS=0.4 ppm			1.4	
	27	1-1.4 Weathered Pierre Shale, homogeneous, stiff, dark greenish gray Gley 3/1					
	28						
	29	PROJECT				HOLE NO.	
	30'	END OF BORING AT 18:00 30' Depth					

RADIAN INTERNATIONAL LLC

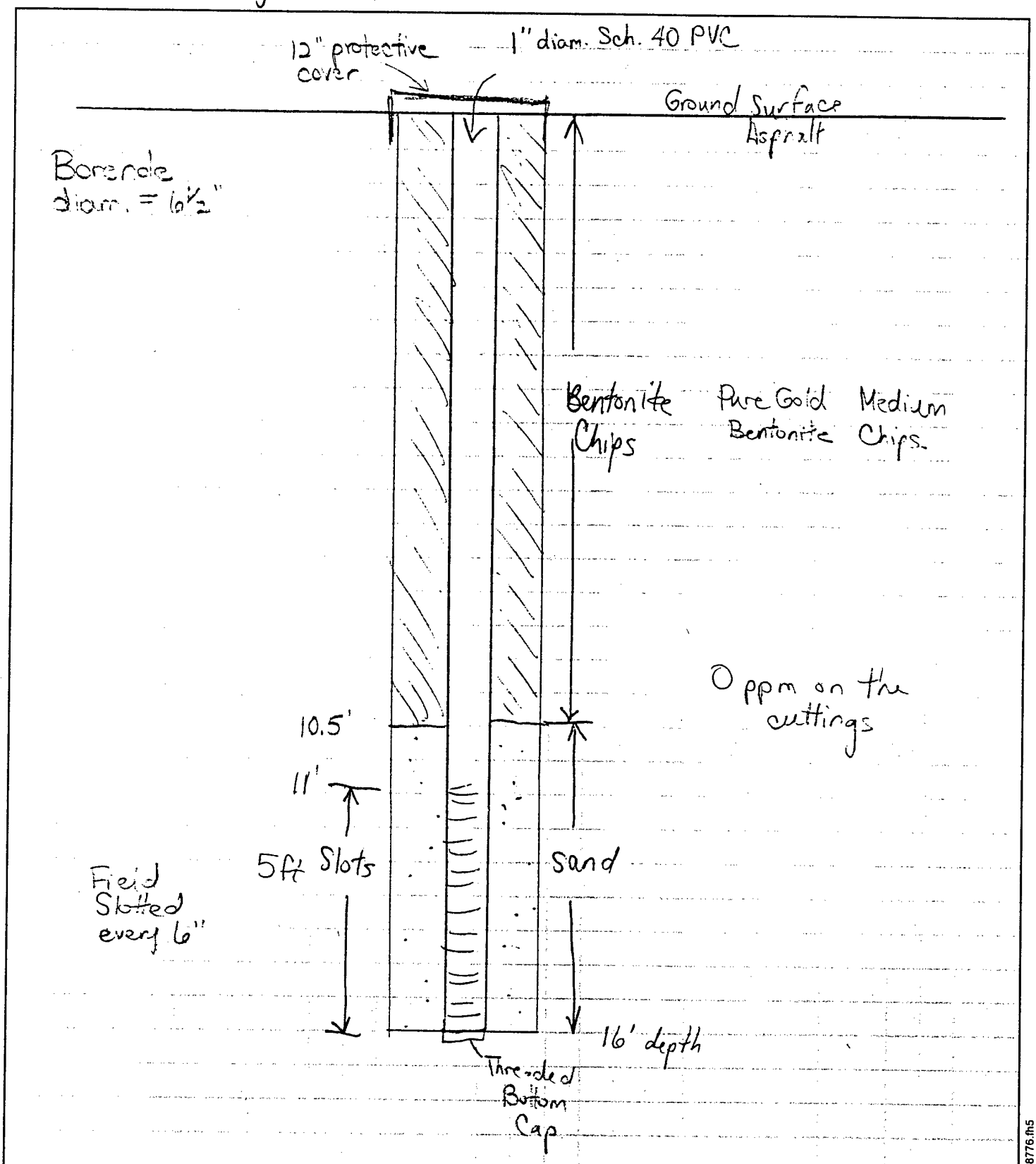
CALCULATION SHEET

CALC. NO. _____

SIGNATURE K Maestas DATE 5/12/96 CHECKED _____ DATE _____

PROJECT 2-Phase Test Ellsworth AFB JOB NO. 612-061-31-30

SUBJECT Pride Hangar V-1 Installation SHEET 1 OF 1 SHEETS



HJP-3 38776.fh5

RADIAN INTERNATIONAL LLC

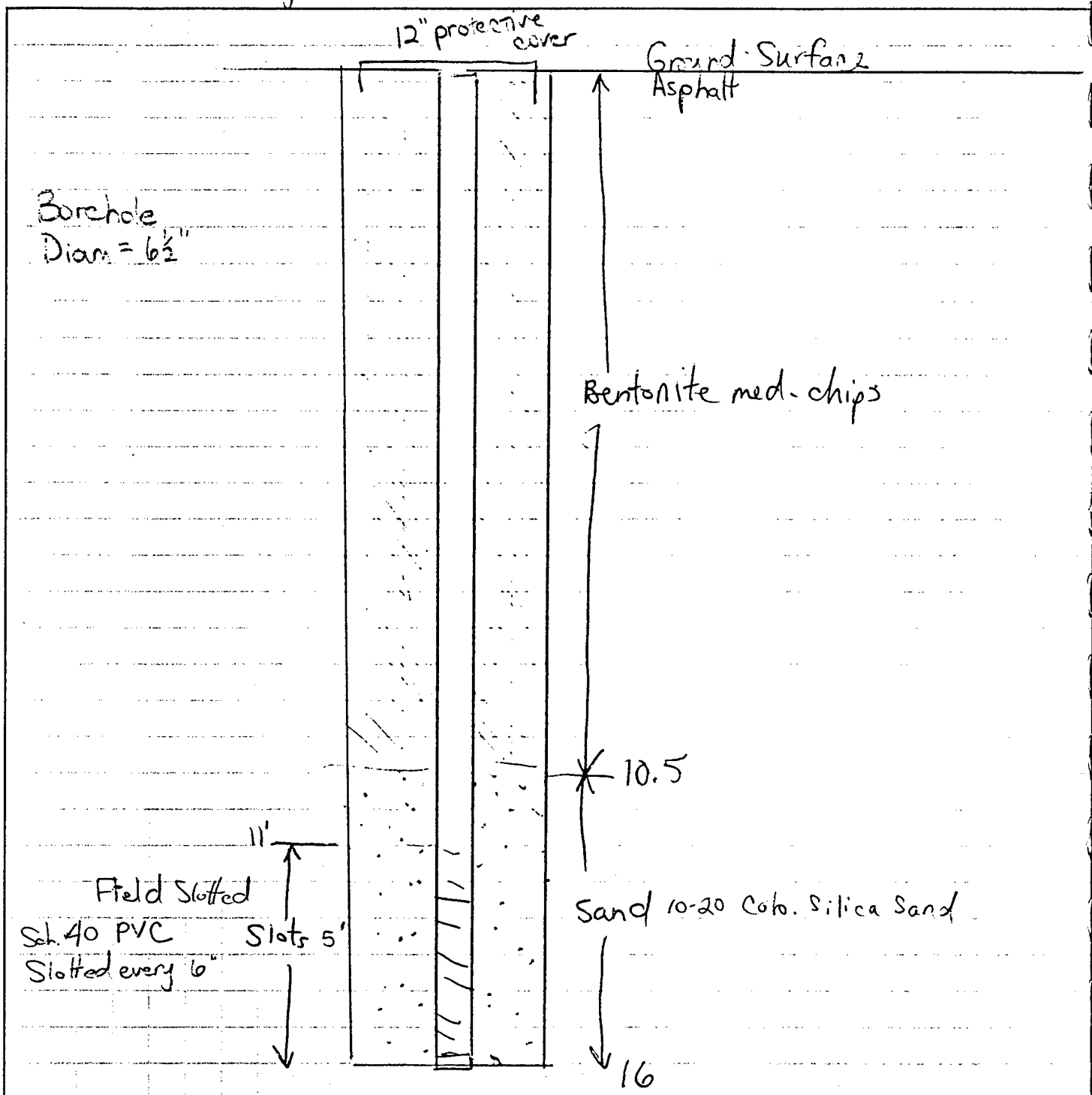
CALCULATION SHEET

CALC. NO. _____

SIGNATURE K Maestas DATE 5/12/96 CHECKED _____ DATE _____

PROJECT 2-Phase Test Ellsworth AFB JOB NO. 612-001-31-30

SUBJECT Pride Hangar V-2 SHEET 1 OF 1 SHEETS



RADIAN INTERNATIONAL LLC

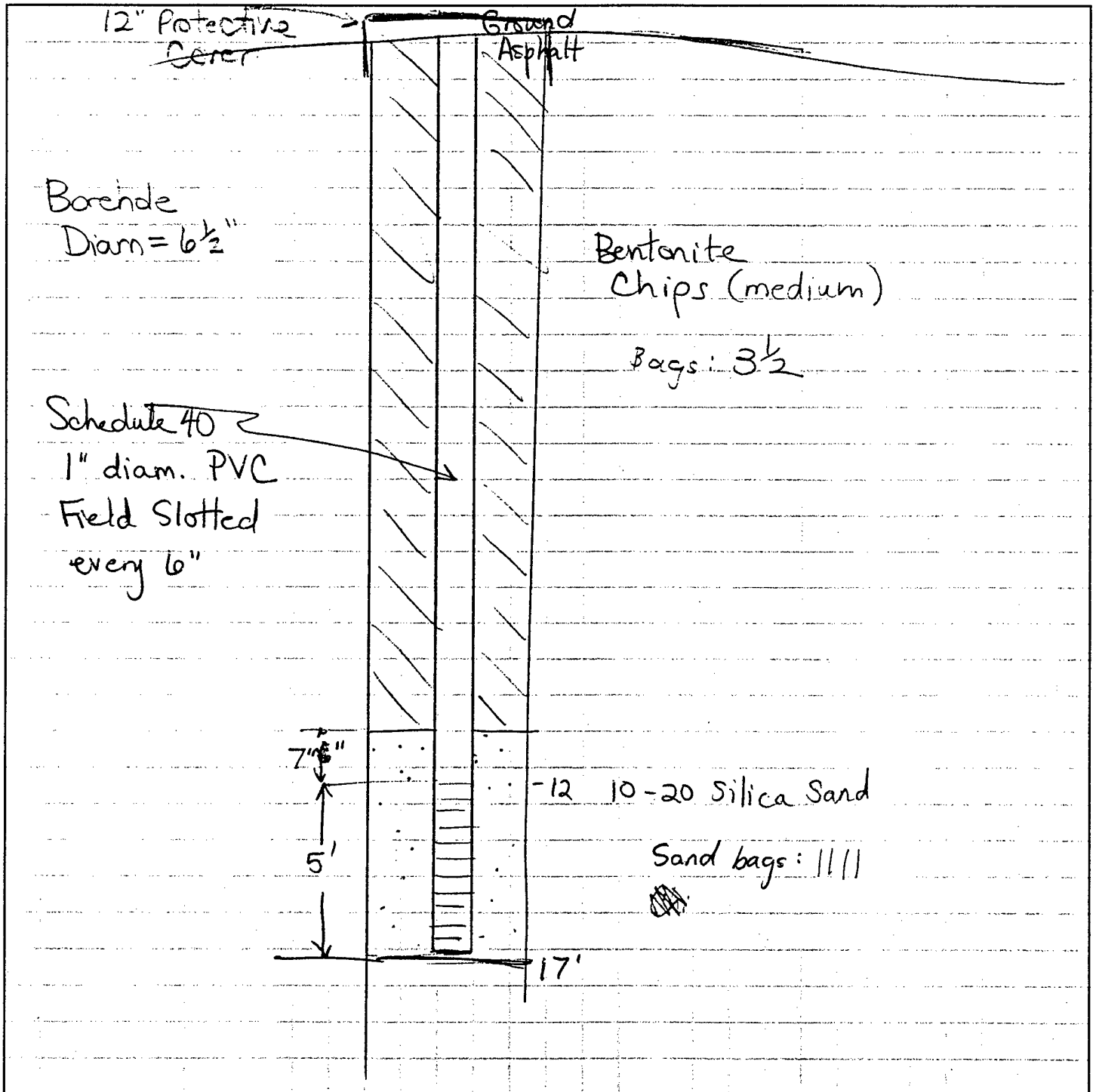
CALCULATION SHEET

CALC. NO. _____

SIGNATURE K. Maestas DATE 5/13/96 CHECKED _____ DATE _____

PROJECT Pride Hangar 2-Phase JOB NO. 612-001-31-30

SUBJECT V-3 Installation SHEET 1 OF 1 SHEETS



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Page 1 of 1

CONTAINERIZED MATERIALS LOG

Project Ellsworth 2-Phase Test - Pride Harbor

City Rapid City State SD

Depth:	Drum Number	Well or Boring Number	Material Type	Date Filed First	Max PID*	Location Moved to	Final Disposition	Signatures of Movers
0-10'	Pride-01	EW-1	Soil	5/10/96	673			
10-15'	Pride-02	EW-1	Soil	5/10/96	7			
15-35'	Pride-03	EW-1	Soil	5/10/96	30			
0-20'	Pride-04	P-1	Soil	5/10/96	10			
20-30' + cuttings	Pride-05	P-1	Soil	5/11/96	0.4			
Cuttings for auger	Pride-06	EW-1	Soil cuttings	5/11/96				
0-30'	Pride-07	P-2	Soil	5/11/96	2.1			
Cuttings for augers	Pride-08	P-2	Soil cuttings	5/12/96				
0-16'	Pride-09	V-1	Soil cuttings	5/12/96	NA			
0-16'	Pride-10	V-2	Soil cuttings	5/12/96	NA			
0-17'	Pride-11	V-3	Soil cuttings	5/13/96	NA			
	Pride-12	EW-1	Decon water	5/13/96	NA			
	Pride-13	EW-1	Decon water	5/13/96	NA			
	Pride-14	P-1	Decon water	5/13/96	NA			
	Pride-15	P-2	Decon water	5/13/96	NA			
+ 9 drums of decon water								

*PID reading is ppm, Headspace.

Recorded by: Karen Mauter

TITLE: IRP Well Development Log

PROJECT Ellsworth AFB

SUBJECT 2-Phase Test

DATE 5/12/96

SHEET 1 OF 1 SHEETS

INSTALLATION ID (AFID)	WELL ID (LOCID)	(LOGDATE)	(LOGTIME)
Ellsworth AFB	EW-1		

PERFORMED BY (LOGCODE)	WATER LEVEL (STATDEP)	TOTAL DEPTH (SOUNDING)
Radian	INITIAL 19.32 below TOC FINAL	INITIAL 32.97 below TOC FINAL

DEVELOPMENT METHOD	SURGE TECHNIQUE
Bailer	

FIELD MEASUREMENTS

Time (LOGTIME)	Cum. Volume (gal)	Water Quality				Water Level	Comments
		°F Temp	pH	µS Cond.	Turb.		
16:00	Start Development						
16 45	30	55	7.2	1800	very silty		
17:10	50	55	7.2	1800	very silty		
17:45	70	56	7.3	1700	very silty		
17:55	75	56	7.3	1700	very silty		
18:20	95	55	7.2	1700	very silty	19.4	
18:41	105	54	7.2	1800	moderately silty		
18:55	110	SAMPLED WELL				19.35	
Final Measurements:							Time

Total Volume Removed 110 gallons

Time for Removal 2hr 55min hrs/min

Figure 3-8. Well Development Log

TITLE: IRP Well Development Log

PROJECT Ellsworth AFB

DATE 5/12/96

SUBJECT 2-Phase Test

SHEET 1 OF 1 SHEETS

INSTALLATION ID (AFID)	WELL ID (LOCID)	(LOGDATE)	(LOGTIME)
Ellsworth AFB	P-1		
PERFORMED BY (LOGCODE)	**WATER LEVEL (STATDEP)** INITIAL / FINAL	**TOTAL DEPTH (SOUNDING)** INITIAL / FINAL	
Radian	19.27 below TOC		
DEVELOPMENT METHOD	**SURGE TECHNIQUE**		
Bailing			
FIELD MEASUREMENTS			

Time (LOGTIME)	Cum. Volume (gal)	Water Quality: Temp	pH	Cond.	Turb.	Water Level	Comments
18:00	START DEVELOPMENT						
18:25	15	55	7.2	1800	very silty to muddy		
18:38	~~20~~ 25 km	54	7.2.	1900	very silty to muddy		
19:00	33	53	7.2	1900	very silty to muddy	19.30	
Final Measurements:							Time

Total Volume Removed 35 gallons

Time for Removal 1hr 10 min hrs/min

Figure 3-8. Well Development Log

TITLE: IRP Well Development Log

PROJECT Ellsworth 2-Phase

DATE 5/13/96

SUBJECT Pride Hangar

SHEET 1 OF 1 SHEETS

INSTALLATION ID (AFID)	WELL ID (LOCID)	(LOGDATE)	(LOGTIME)
Ellsworth AFB	P-2		
PERFORMED BY (LOGCODE)	**WATER LEVEL (STATDEP)** INITIAL / FINAL	**TOTAL DEPTH (SOUNDING)** INITIAL / FINAL	
Radian	19.30 below TOC		
DEVELOPMENT METHOD		**SURGE TECHNIQUE**	
bailers			
FIELD MEASUREMENTS			

Time (LOGTIME)	Cum. Volume (gal)	Water Quality: Temp	pH	Cond.	Turb.	Water Level	Comments
9:10	START DEVELOPMENT					19.30	
9:25	10	54	7.2	1600	very silty		
9:45	20	55	7.2	1500	very silty		
9:55	22	56	7.2	1600	very silty		
Final Measurements:							Time

Total Volume Removed 25 gallons

Time for Removal 1 hr. hrs/min

Figure 3-8. Well Development Log

APPENDIX B

Field Data Tables

Pride Hangar Site

Field Measurements Data Sheet

Date	Time	Water Level (ft below top of casing)					Piezometer Vacuum (in.WC)			Vapor Probe Vacuum (in. WC)			Weather		Comments
		Piezometers		Monitoring Wells (MW)									Temp.	Baro.	
		P1	P2	941103	941104	941129	P1	P2	941103	V1	V2	V3	(deg F)	(mb)	
5/10/96	16:00			20.94											depth total = 23 feet
5/13/96	13:05	21.83 *	20.85 *	22.27 *			0	0	0	0	0	0		906	pre test
5/13/96	14:33	22.26	21.2	22.46			0	0	0	0	0	0			1-1/4" straw
5/13/96	15:20	22.36	21.29	22.54			0	0	0	0	0	0	65		
5/13/96	16:15	22.42	21.34	22.59			0	0	0	0	0	0			
5/13/96	17:48	22.45	21.37	22.62										902	increase straw to 1-1/2"
5/14/96	14:40	21.81	20.83	22.27	19.21	19.21									prior to startup of test on 14th
5/14/96	15:40	22.47	21.35	22.51			0	0	0	0	0	0	70		2" straw
5/14/96	16:30	22.57	21.44	22.6			0	0	0	0	0		70	897	
5/14/96	18:00	21.99	21.02	22.47			0	0	0	0	0	0			prior to startup
5/14/96	18:25	22.45	21.35	22.57			0	0	0	0	0	0		896	2" straw
5/14/96	18:40	22.57	21.46	22.62			0	0	0	0	0	0			
5/14/96	19:05	-	21.5	22.68			0.04	0	0	0	0	0			
5/14/96	19:10						0.35	0	0.05	0.01	0	0			
5/14/96	19:50	22.7	21.55	22.74			0.15	0.02	0.08	0.02	0.02	0.02			prior to shutdown
5/15/96	8:45	21.9	20.93	22.36											pre test
5/15/96	9:00	22.35	21.24	22.46											
5/15/96	9:20						0.16	0	0.08	0.01	0	0.01			
5/15/96	9:45	22.55	21.44	22.62			0.08	0.01	0.08	0.01	0.01	0.01		892	
5/15/96	11:00	22.68	21.57	22.75			0.04	0	0.1	0	0	0.02		902	
5/15/96	12:00	22.74	21.63	22.82	19.47	19.3	0.06	0.01	0.09	0.02	0.03	0.04			
5/15/96	12:30						0.05	0.02	0.09	0.03	0.01	0.01			
5/15/96	12:55	22.78	21.68	22.87									75	901	
5/15/96	14:00	22.81	21.71	22.9			0.05	0.02	0.1	0.04	0.02	0.02			
5/15/96	15:00	22.84	21.74	22.95			0.03	0.01	0.07	0.02	0.01	0.02			
5/15/96	16:00	22.82	21.74	22.96			0.03	0.01	0.07	0.01	0.02	0.02			shutdown at 16:02 for 13 minutes
5/15/96	17:00						0.1	0.04	0.09	0.04	0.02	0.04			
5/15/96	17:40	22.89	21.79	23.01									75	899	
5/15/96	18:45	22.93	21.84	23.05			0.08	0.05	0.12	0.04	0.06	0.06	68	900	thunderstorm
5/15/96	22:20	23	21.9	23.13			0.01	0.02	0.06	0	0	0.03	60	901	after thunderstorm
5/16/96	5:30	23.08	22	23.24	19.64	19.37	0.01	0.01	0.04	0	0	0.01			
5/16/96	6:30	23.1	22	23.25			0.02	0.01	0.03	0	0	0.02			
5/16/96	7:05	23.1	22	23.25			0.01	0.01	0.04	0.04	0	0.02			prior to shutdown
5/16/96	8:00	22.57	21.63	23.06											post test water levels
5/16/96	8:30	22.5	21.56	23											
5/16/96	9:00	22.46	21.52	22.96											
5/16/96	9:30	22.41	21.47	22.92									65	897	
5/16/96	10:30	22.35	21.41	22.86										896	final measurements

* Measured from top of piezometer stick-up

Ellsworth Air Force Base - Two (2) Phase Pilot Test (Pride Hangar)

2-PHASE System Operating Conditions Data Sheet

			System Inlet		Wellhead		Seal Fluid				Exhaust Vapor					
Date	Time	Total Operating Hours	Temp. (deg F)	Vacuum (in. Hg)	Top of Straw Vacuum (in. Hg)	Well Vacuum (in. Hg)	Temp. (deg F)	Pressure at Pump (psi)	Oil Pot Temp. (deg F)	Oil Pot Pressure (psi)	Temp. (deg F)	Pressure (psi)	Flow (scfm)	Aspir. Flow (scfm)	Totalizer Liquid Volume (gal)	Comments
5/12/96		2651.4														Prior to test start - *
5/13/96	13:05	2651.9													0	start up
5/13/96	14:17	2653	43	28.0		0	178	1	180	17	100			0	497	
5/14/96	14:40	2656.8													2642	start up
5/14/96	15:00	2657	40	29.0		1	180	1	180	16	130	1	6	6		
5/14/96	16:00	2658	40	29.0	-	1	180	1	180	16	138	1	6	6	3146	
5/14/96	16:35	2658.6	41	29.0	-	2	178	1	180	16	120	1	7	7	4130	
5/14/96	18:05	2659.1	40												4397	start up
5/14/96	18:40	2659.8	40	27.5	-	2.5	175	1	180	17	70	1	5	5	4912	
5/14/96	20:05	2661	40	did not read	-	2.5	175	1	178	17	70	1	7	7	6162	shutdown for night
5/15/96	8:45	2661.3													6162	pre-test start up
5/15/96	9:00	2661.6	40	26.5	-	0	174	1	180	19	72	1	14	14	6340	
5/15/96	9:55	2662.4	40	27.0	-	2	176	1	180	17	77	1	10	9	7130	20-deg. aspir. air valve
5/15/96	11:05	2663.7	40	28.0	-	3	176	1	180	17	79	1	7	5.6	8202	straw at max - 29' @ 11:15; aspir. - 45-deg
5/15/96	14:00	2666.6	40	28.0	-	3.5	176	1	180	16	78	1	4	3	10844	
5/15/96	14:45	2667.3	40	28.0	-	3.5	176	1	180	16	76	1	5	2.5	11430	
5/15/96	16:02															shutdown at 16:02 for 13 minutes
5/15/96	17:00	2669.6	40	29.0	-	3.5	176	1	180	15	78	1	5	4	13210	
5/15/96	18:45	2671.4	40	27.5	-	3.5	176	1.5	180	16.5	76	1	5	4	14790	thunderstorm
5/15/96	22:25	2675.1	40	26.0	-	3.5	176	2	178	18	62	1	5	4.5	18030	cutback aspiration, asp=3.5; total=4
5/16/96	5:45	2682.6	40	26.0	-	4	176	1	178	18	58	1	3.5	3.5	22422	
5/16/96	6:45	2683.6	40	26.5	-	3.5	176	1	178	18	58	1	2	2	25280	
5/16/96	7:10	2684	40	26.5	-	3.5	176	1	178	18	60	1	2	2	25650	
5/16/96	7:30	End of test													25737	total flow for tests

* started unit on 5/12/96 to test system

Ellsworth Air Force Base - Two (2) Phase Pilot Test (Pride Hangar)

Analytical Sampling Field Data Sheet

Date	Time	Extracted Liquid SW-8260/8015M	Extracted Vapor AM4.02	Liquid Duplicate SW-8260/8015M	Liquid Trip Blank SW-8260	Vapor Duplicate AM4.02	Groundwater SW-8260/8015M
5/12/96	19:00				X		EW-1 Pre Test
5/13/96	15:40	Pride discharge - 1			X		
5/14/96	16:00	Pride discharge - 2	Pride V-1				
5/14/96	19:00		Pride V-2				
5/14/96	20:00	Pride discharge - 3					
5/15/96	10:10	Pride discharge - 4	Pride V-3				
5/15/96	14:45	Pride discharge - 5	Pride V-4		X		
5/16/96	6:10		Pride V-5				
5/16/96	7:00	Pride discharge - 6	Pride V-6				
5/16/96	7:00		Pride V-6D			X	
5/16/96	9:45			EW-ID Post Test	X		EW-I Post Test

APPENDIX C

Groundwater Sample Analytical Data

ENERGY LABORATORIES, INC.
P.O. BOX 2470 • RAPID CITY, SD 57709 • PHONE (605) 342-1225
610 FARNWOOD STREET • RAPID CITY, SD 57701 • FAX (605) 342-1397

Radian Corporation
P.O. Box 201088
Austin, TX 78720-1088

Ellsworth AFB, Pride Hanger
Sampled: 05-12-96

May 14, 1996
96-23291
Submitted: 05-13-96

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
Water Analysis							
EW-1 Pretest		96-23291	EPA 8015 Mod.	TPH as Gasoline	43*	µg/L ppb	DM:05-13-96

8260 LONG RH:05-13-96

	µg/L		POL
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	1.6		1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	97	(1)	1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

EW-1 Pretest 96-23291 **8260 LONG** RH:05-13-96

		ug/L	PQL
1,2,4-Trichlorobenzene		<1.0	1.0
Naphthalene		<1.0	1.0
Hexachlorobutadiene		<1.0	1.0
1,2,3-Trichlorobenzene		<1.0	1.0
Acetone		<20	20
Methyl Ethyl Ketone		<10	10
Dichlorodifluoromethane		<1.0	1.0
Chloromethane		<1.0	1.0
Vinyl Chloride		<1.0	1.0
Bromomethane		<1.0	1.0
Chloroethane		<1.0	1.0
Trichlorofluoromethane		<1.0	1.0
2-Chloroethylvinylether		<1.0	1.0
Carbon Disulfide		<1.0	1.0
Vinyl Acetate		<1.0	1.0
Methyl Isobutyl Ketone		<10	10
2-Hexanone		<10	10
Acrolein		<10	10
Acrylonitrile		<10	10
Methyltertiary Butyl Ether		<1.0	1.0
Iodomethane		<1.0	1.0
Surrogate Recoveries			
1,2-Dichloroethane-d4		118	% Recovery
Toluene-d8		111	
4-Bromofluorobenzene		101	

(1)-Value derived from a 10x dilution.
* TPH value derived from a single peak on the chromatogram. The elution time is consistent with trichloroethene.

Kurt R. Slentz
Laboratory Manager

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank — **8260 LONG** — RH:05-13-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	101	% Recovery
Toluene-d8	111	
4-Bromofluorobenzene	106	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Trip Blank — 8260 LONG — RH:05-13-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	115	% Recovery
Toluene-d8	105	
4-Bromofluorobenzene	101	

ENERGY LABORATORIES, INC.
RAPID CITY, SD

TPH AS GASOLINE & MBTEX
PID SURROGATE RECOVERY

LAB NUMBER	PID SURROGATE RECOVERY	
	TRIFLUOROTOLUENE	4-BROMOFLUORO-BENZENE
96 23291	85	83

CERTIFIED KNOWN DATA

Compound	Known	Lot #	True Value	Conc.	% Recovery	TFT % Rec	BFB % Rec	QC Limits
GAS	ERA	40002	510 ug/L	392 ug/L	77	121	100	60-140%

ENERGY LABORATORIES, INC.
P.O. Box 2470 610 Farnwood Street voice 605-342-1225
Rapid City, SD 57709 fax 605-342-1397

CHAIN OF CUSTODY RECORD

PLEASE PRINT OR TYPE ALL INFORMATION EXCEPT SIGNATURES

P.O. #

Project Name / Address: Ellsworth AFB Pride Hangar

Contact Name & Phone: James Madsen

Sampler's signature:

Invoice to:

Report to:

DATE	TIME	composite	grab sample	SAMPLE I.D.	number of containers	Sample Type: A W S V U O (Air Water Soils/solids Vegetation Urine Other)	Analysis Requested: 8015M	8260						Comments, Special Instructions, etc.
5/12/96	18:55			EW-1 Pretest	4		✓	✓						Include cis-1,2-DCE
5/12/96	—			Trip Blanks	2		✓	✓						Include cis-1,2-DCE

1. Relinquished (signature)	Date	Time	Received by: (signature)	3. Relinquished (signature)	Date	Time	Received by (signature):	
	5/12/96	1910						
2. Relinquished (signature)	Date	Time	Received by: (signature)	4. Relinquished (signature)	Date	Time	Received for laboratory by (signature):	
					5/13/96	8:21	Marcie Sprague	

C-6

ENERGY LABORATORIES, INC.
P.O. BOX 2470 • RAPID CITY, SD 57709 • PHONE (605) 342-1225
610 FARNWOOD STREET • RAPID CITY, SD 57701 • FAX (605) 342-1397

James Machin
Radian International
P.O. Box 201088
Austin, TX 78720-1088

Ellsworth AFB, Pride Hangar
Sampled: 05-13-96

May 15, 1996
96-23296
Submitted: 05-14-96

Site	Depth	Lab No.	Methodology	Analysis	Results		Units	Analyzed

Water Analysis

Pride Hangar Site
Discharge #1 — 96-23296 — **8260 LONG** — RH:05-14-96

Analysis	Results		PQL
	µg/L		
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	1.4		1.0
Bromochloromethane	<1.0		1.0
Chloroform	2.6		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	77	(1)	1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0
1,2,4-Trichlorobenzene	<1.0		1.0
Naphthalene	<1.0		1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Pride Hangar Site cont.
Discharge #1 96-23296 8260 LONG RH:05-14-96

Analysis	µg/L	PQL
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries		
1,2-Dichloroethane-d4	119	% Recovery
Toluene-d8	105	
4-Bromofluorobenzene	99	

(1)-Value derived from a 10x dilution.
NOTE: Chromatographic data did not indicate the presence of hydrocarbon (petroleum) contaminants.

Kurt R. Slentz
Laboratory Manager

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank **8260 LONG**

RH:05-14-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	101	% Recovery
Toluene-d8	116	
4-Bromofluorobenzene	107	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Trip Blank **8260 LONG** RH:05-14-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	120	% Recovery
Toluene-d8	104	
4-Bromofluorobenzene	105	

ENERGY LABORATORIES, INC.
P.O. Box 2470 610 Farnwood Street voice 605-342-1225
Rapid City, SD 57709 fax 605-342-1397

CHAIN OF CUSTODY RECORD

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P.O. #

Project Name / Address: ELLSWORTH AFB PRIDE HANGAR

Contact Name & Phone: JAMES MACHIN

Sampler's signature: Bill Bullock

Invoice to:

Report to:

DATE	TIME	composite	grab sample	SAMPLE I.D.	number of containers	Sample Type: A W S V U O (Air Water Soils/solids Vegetation Urine Other)	Analysis Requested: 8015	8260						Comments, Special Instructions, etc.
5/13/96	15:40			PRIDE HANGAR SITE DISCHARGE #1	3		✓	✓						RAPID TURNAROUND
5/13/96				TRIP BLANKS	2									

1. Relinquished (signature)	Date	Time	Received by: (signature)	3. Relinquished (signature)	Date	Time	Received by (signature):
Bill Bullock	5/14/96	07:42					
2. Relinquished (signature)	Date	Time	Received by: (signature)	4. Relinquished (signature)	Date	Time	Received for laboratory by (signature):

C-11

ENERGY LABORATORIES, INC.
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James Machin
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P.O. Box 201088
Austin, TX 78720-1088

Ellsworth AFB, Pride Hangar
Sampled: 05-14/15-96

May 24, 1996
96-23352-55
Submitted: 05-16-96

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Water Analysis

Effluent Discharge No. 2 96-23352 **8260 LONG**

RH:05-22-96

	µg/L		PQL
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	<1.0	(2)	1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	37	(1)	1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0
1,2,4-Trichlorobenzene	<1.0		1.0
Naphthalene	<1.0		1.0
Hexachlorobutadiene	<1.0		1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Effluent Discharge No. 2 96-23352 **8260 LONG** RH:05-22-96

	µg/L		PQL
1,2,3-Trichlorobenzene	<1.0		1.0
Acetone	<20		20
Methyl Ethyl Ketone	<10	(2)	10
Dichlorodifluoromethane	<1.0		1.0
Chloromethane	<1.0		1.0
Vinyl Chloride	<1.0		1.0
Bromomethane	<1.0		1.0
Chloroethane	<1.0		1.0
Trichlorofluoromethane	<1.0		1.0
2-Chloroethylvinylether	<1.0		1.0
Carbon Disulfide	<1.0		1.0
Vinyl Acetate	<1.0		1.0
Methyl Isobutyl Ketone	<10		10
2-Hexanone	<10		10
Acrolein	<10		10
Acrylonitrile	<10		10
Methyltertiary Butyl Ether	<1.0		1.0
Iodomethane	<1.0		1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	103	% Recovery
Toluene-d8	100	
4-Bromofluorobenzene	99	

(1)-Value derived from a 10x dilution.
(2)-Present but less than the PQL.

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Effluent Discharge No. 3 96-23353 **8260 LONG**

RH:05-22-96

	µg/L		PQL
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	<1.0	(2)	1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	56	(1)	1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0
1,2,4-Trichlorobenzene	<1.0		1.0
Naphthalene	<1.0		1.0
Hexachlorobutadiene	<1.0		1.0
1,2,3-Trichlorobenzene	<1.0		1.0
Acetone	<20		20
Methyl Ethyl Ketone	<10		10
Dichlorodifluoromethane	<1.0		1.0
Chloromethane	<1.0		1.0
Vinyl Chloride	<1.0		1.0
Bromomethane	<1.0		1.0
Chloroethane	<1.0		1.0
Trichlorofluoromethane	<1.0		1.0
2-Chloroethylvinylether	<1.0		1.0
Carbon Disulfide	<1.0		1.0
Vinyl Acetate	<1.0		1.0
Methyl Isobutyl Ketone	<10		10
2-Hexanone	<10		10
Acrolein	<10		10
Acrylonitrile	<10		10
Methyltertiary Butyl Ether	<1.0		1.0
Iodomethane	<1.0		1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	103	% Recovery
Toluene-d8	102	
4-Bromofluorobenzene	104	

(1)-Value derived from a 10x dilution.
(2)-Present but less than the PQL.

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Effluent Discharge No. 4 96-23354 8260 LONG

RH:05-22-96

	µg/L		POL
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	<1.0	(2)	1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	34	(1)	1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0
1,2,4-Trichlorobenzene	<1.0		1.0
Naphthalene	<1.0		1.0
Hexachlorobutadiene	<1.0		1.0
1,2,3-Trichlorobenzene	<1.0		1.0
Acetone	<20		20
Methyl Ethyl Ketone	<10		10
Dichlorodifluoromethane	<1.0		1.0
Chloromethane	<1.0		1.0
Vinyl Chloride	<1.0		1.0
Bromomethane	<1.0		1.0
Chloroethane	<1.0		1.0
Trichlorofluoromethane	<1.0		1.0
2-Chloroethylvinylether	<1.0		1.0
Carbon Disulfide	<1.0		1.0
Vinyl Acetate	<1.0		1.0
Methyl Isobutyl Ketone	<10		10
2-Hexanone	<10		10
Acrolein	<10		10
Acrylonitrile	<10		10
Methyltertiary Butyl Ether	<1.0		1.0
Iodomethane	<1.0		1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	101	% Recovery
Toluene-d8	99	
4-Bromofluorobenzene	101	

(1)-Value derived from a 10x dilution.
(2)-Present but less than the PQL.

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Effluent Discharge No. 5 96-23355 8260 LONG

RH:05-23-96

	µg/L		PQL
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	<1.0	(2)	1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	78	(1)	1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0
1,2,4-Trichlorobenzene	<1.0		1.0
Naphthalene	<1.0		1.0
Hexachlorobutadiene	<1.0		1.0
1,2,3-Trichlorobenzene	<1.0		1.0
Acetone	<20		20
Methyl Ethyl Ketone	<10		10
Dichlorodifluoromethane	<1.0		1.0
Chloromethane	<1.0		1.0
Vinyl Chloride	<1.0		1.0
Bromomethane	<1.0		1.0
Chloroethane	<1.0		1.0
Trichlorofluoromethane	<1.0		1.0
2-Chloroethylvinylether	<1.0		1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Effluent Discharge No. 5 96-23355 8260 LONG

RH:05-23-96

	µg/L	PQL
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	102	% Recovery
Toluene-d8	101	
4-Bromofluorobenzene	100	

(1)-Value derived from a 10x dilution.
(2)-Present but less than the PQL.

Kurt R. Slentz
Laboratory Manager

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank **8260 LONG** RH:05-22-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	94	% Recovery
Toluene-d8	106	
4-Bromofluorobenzene	106	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank **8260 LONG** RH:05-23-96

	µg/L	POL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	100	% Recovery
Toluene-d8	104	
4-Bromofluorobenzene	101	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Trip Blank **8260 LONG** RH:05-22-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	99	% Recovery
Toluene-d8	102	
4-Bromofluorobenzene	104	

ENERGY LABORATORIES, INC.
P.O. Box 2470 610 Farnwood Street voice 605-342-1225
Rapid City, SD 57709 fax 605-342-1397

CHAIN OF CUSTODY RECORD

PLEASE PRINT OR TYPE ALL INFORMATION EXCEPT SIGNATURES

P.O. #

Project Name / Address: ELLSWORTH AFB
RADIAN - PRIDE HANGAR SITE

Contact Name & Phone: JAMES MACHIN

Sampler's signature:

Invoice to:

Report to:

DATE	TIME	composite	grab sample	SAMPLE I.D.	number of containers	Sample Type: A W S V U O (Air Water Soils/solids Vegetation Urine Other)	Analysis Requested: 8260								Comments, Special Instructions, etc.
5/14/96	1600			EFFLUENT DISCHARGE No 2	3	W	✓								2 Triplicates
5/14/96	2000			EFFLUENT DISCHARGE No 3	3	W	✓								
5/15/96	1000			EFFLUENT DISCHARGE No 4	3	W	✓								
5/15/96	1430			EFFLUENT DISCHARGE No. 5	3	W	✓								

1. Relinquished (signature)	Date	Time	Received by: (signature)	3. Relinquished (signature)	Date	Time	Received by (signature):
[signature]	5/16/96	0847					
2. Relinquished (signature)	**Date**	**Time**	**Received by: (signature)**	**4. Relinquished (signature)**	**Date**	**Time**	**Received for laboratory by (signature):**
					5/16/96	8:47	Marcie Sprague

C-21

ENERGY LABORATORIES, INC.
P.O. BOX 2470 • RAPID CITY, SD 57709 • PHONE (605) 342-1225
610 FARNWOOD STREET • RAPID CITY, SD 57701 • FAX (605) 342-1397

James Machin
Radian Corporation
P.O. Box 201088
Austin, TX 78720-1088

Ellsworth AFB, Pride Hangar
Sampled: 05-16-96

May 22, 1996
96-23373-76
Submitted: 05-17-96

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Water Analysis

Effluent Discharge #6 96-23373 **8260 LONG**

RH:05-20-96

	µg/L		PQL
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	1.4		1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	78	(1)	1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0
1,2,4-Trichlorobenzene	<1.0		1.0
Naphthalene	<1.0		1.0
Hexachlorobutadiene	<1.0		1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Effluent Discharge #6 96-23373 8260 LONG RH:05-20-96

Analysis	µg/L		PQL
1,2,3-Trichlorobenzene	<1.0		1.0
Acetone	<20		20
Methyl Ethyl Ketone	<10		10
Dichlorodifluoromethane	<1.0		1.0
Chloromethane	<1.0		1.0
Vinyl Chloride	<1.0		1.0
Bromomethane	<1.0		1.0
Chloroethane	<1.0		1.0
Trichlorofluoromethane	<1.0		1.0
2-Chloroethylvinylether	<1.0		1.0
Carbon Disulfide	<1.0		1.0
Vinyl Acetate	<1.0		1.0
Methyl Isobutyl Ketone	<10		10
2-Hexanone	<10		10
Acrolein	<10		10
Acrylonitrile	<10		10
Methyltertiary Butyl Ether	<1.0		1.0
Iodomethane	<1.0		1.0
Surrogate Recoveries			
1,2-Dichloroethane-d4	97		% Recovery
Toluene-d8	102		
4-Bromofluorobenzene	101		

(1)-Value derived from a 10x dilution.

EW-1 Post Test 96-23374 8260 LONG RH:05-20-96

Analysis	µg/L		PQL
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	3.3		1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	410	(1)	1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

EW-1 Post Test 96-23374 8260 LONG RH:05-20-96

Analysis	µg/L		PQL
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0
1,2,4-Trichlorobenzene	<1.0		1.0
Naphthalene	<1.0		1.0
Hexachlorobutadiene	<1.0		1.0
1,2,3-Trichlorobenzene	<1.0		1.0
Acetone	<20		20
Methyl Ethyl Ketone	50		10
Dichlorodifluoromethane	<1.0		1.0
Chloromethane	<1.0		1.0
Vinyl Chloride	<1.0		1.0
Bromomethane	<1.0		1.0
Chloroethane	<1.0		1.0
Trichlorofluoromethane	<1.0		1.0
2-Chloroethylvinylether	<1.0		1.0
Carbon Disulfide	<1.0		1.0
Vinyl Acetate	<1.0		1.0
Methyl Isobutyl Ketone	<10		10
2-Hexanone	<10		10
Acrolein	<10		10
Acrylonitrile	<10		10
Methyltertiary Butyl Ether	<1.0		1.0
Iodomethane	<1.0		1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	102	% Recovery
Toluene-d8	104	
4-Bromofluorobenzene	101	

(1)-Value derived from a 50x dilution.

EW-1B Post Test 96-23375 8260 LONG RH:05-20-96

Analysis	µg/L		PQL
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	2.5		1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	390	(1)	1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

EW-1B Post Test 96-23375 8260 LONG RH:05-20-96

Analysis	µg/L	PQL
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	25	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	101	% Recovery
Toluene-d8	100	
4-Bromofluorobenzene	105	

(1)-Value derived from a 50x dilution.

EW-2 Pre Test 96-23376 8260 LONG RH:05-17-96

Analysis	µg/L	PQL
1,1-Dichloroethene	<2.0	2.0
Methylene Chloride	<2.0	2.0
trans-1,2-Dichloroethene	<2.0	2.0
1,1-Dichloroethane	<2.0	2.0
2,2-Dichloropropane	<2.0	2.0
cis-1,2-Dichloroethene	<2.0	2.0
Bromochloromethane	<2.0	2.0
Chloroform	<2.0	2.0
1,1,1-Trichloroethane	<2.0	2.0
Carbon Tetrachloride	<2.0	2.0
1,1-Dichloropropene	<2.0	2.0
Benzene	<2.0	2.0
1,2-Dichloroethane	<2.0	2.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

EW-2 Pre Test 96-23376 8260 LONG

RH:05-17-96

	µg/L		PQL
Trichloroethene	45	(1)	2.0
1,2-Dichloropropane	<2.0		2.0
Dibromomethane	<2.0		2.0
Bromodichloromethane	<2.0		2.0
Trans-1,3-Dichloropropene	<2.0		2.0
Toluene	<2.0		2.0
cis-1,3-Dichloropropene	<2.0		2.0
1,1,2-Trichloroethane	<2.0		2.0
Tetrachloroethene	<2.0		2.0
1,3-Dichloropropane	<2.0		2.0
Dibromochloromethane	<2.0		2.0
1,2-Dibromoethane	<2.0		2.0
Chlorobenzene	<2.0		2.0
1,1,1,2-Tetrachloroethane	<2.0		2.0
Ethylbenzene	<2.0		2.0
M+P Xylenes	<2.0		2.0
O-Xylene	<2.0		2.0
Styrene	<2.0		2.0
Bromoform	<2.0		2.0
Isopropylbenzene	<2.0		2.0
Bromobenzene	<2.0		2.0
1,1,2,2-Tetrachloroethane	<2.0		2.0
1,2,3-Trichloropropane	<2.0		2.0
n-Propylbenzene	<2.0		2.0
2-Chlorotoluene	<2.0		2.0
4-Chlorotoluene	<2.0		2.0
1,3,5-Trimethylbenzene	<2.0		2.0
tert-Butylbenzene	<2.0		2.0
1,2,4-Trimethylbenzene	<2.0		2.0
sec-Butylbenzene	<2.0		2.0
1,3-Dichlorobenzene	<2.0		2.0
1,4-Dichlorobenzene	<2.0		2.0
p-Isopropyltoluene	<2.0		2.0
1,2-Dichlorobenzene	<2.0		2.0
n-Butylbenzene	<2.0		2.0
1,2-Dibromo-3-Chloropropane	<2.0		2.0
1,2,4-Trichlorobenzene	<2.0		2.0
Naphthalene	<2.0		2.0
Hexachlorobutadiene	<2.0		2.0
1,2,3-Trichlorobenzene	<2.0		2.0
Acetone	<40		20
Methyl Ethyl Ketone	<20		20
Dichlorodifluoromethane	<2.0		2.0
Chloromethane	<2.0		2.0
Vinyl Chloride	<2.0		2.0
Bromomethane	<2.0		2.0
Chloroethane	<2.0		2.0
Trichlorofluoromethane	<2.0		2.0
2-Chloroethylvinylether	<2.0		2.0
Carbon Disulfide	<2.0		2.0
Vinyl Acetate	<2.0		2.0
Methyl Isobutyl Ketone	<20		20
2-Hexanone	<20		20
Acrolein	<20		20
Acrylonitrile	<20		20
Methyltertiary Butyl Ether	<2.0		2.0
Iodomethane	<2.0		2.0

Surrogate Recoveries

1,2-Dichloroethane-d4	111	% Recovery
Toluene-d8	114	
4-Bromofluorobenzene	107	

(1)-Value derived from a 5x dilution.

Kurt R. Slentz
Laboratory Manager

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank 8260 LONG

RH:05-17-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	111	% Recovery
Toluene-d8	113	
4-Bromofluorobenzene	106	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank		8260 LONG		µg/L	PQL	RH:05-20-96
			1,1-Dichloroethene	<1.0	1.0	
			Methylene Chloride	<1.0	1.0	
			trans-1,2-Dichloroethene	<1.0	1.0	
			1,1-Dichloroethane	<1.0	1.0	
			2,2-Dichloropropane	<1.0	1.0	
			cis-1,2-Dichloroethene	<1.0	1.0	
			Bromochloromethane	<1.0	1.0	
			Chloroform	<1.0	1.0	
			1,1,1-Trichloroethane	<1.0	1.0	
			Carbon Tetrachloride	<1.0	1.0	
			1,1-Dichloropropene	<1.0	1.0	
			Benzene	<1.0	1.0	
			1,2-Dichloroethane	<1.0	1.0	
			Trichloroethene	<1.0	1.0	
			1,2-Dichloropropane	<1.0	1.0	
			Dibromomethane	<1.0	1.0	
			Bromodichloromethane	<1.0	1.0	
			Trans-1,3-Dichloropropene	<1.0	1.0	
			Toluene	<1.0	1.0	
			cis-1,3-Dichloropropene	<1.0	1.0	
			1,1,2-Trichloroethane	<1.0	1.0	
			Tetrachloroethene	<1.0	1.0	
			1,3-Dichloropropane	<1.0	1.0	
			Dibromochloromethane	<1.0	1.0	
			1,2-Dibromoethane	<1.0	1.0	
			Chlorobenzene	<1.0	1.0	
			1,1,1,2-Tetrachloroethane	<1.0	1.0	
			Ethylbenzene	<1.0	1.0	
			M + P Xylenes	<1.0	1.0	
			O-Xylene	<1.0	1.0	
			Styrene	<1.0	1.0	
			Bromoform	<1.0	1.0	
			Isopropylbenzene	<1.0	1.0	
			Bromobenzene	<1.0	1.0	
			1,1,2,2-Tetrachloroethane	<1.0	1.0	
			1,2,3-Trichloropropane	<1.0	1.0	
			n-Propylbenzene	<1.0	1.0	
			2-Chlorotoluene	<1.0	1.0	
			4-Chlorotoluene	<1.0	1.0	
			1,3,5-Trimethylbenzene	<1.0	1.0	
			tert-Butylbenzene	<1.0	1.0	
			1,2,4-Trimethylbenzene	<1.0	1.0	
			sec-Butylbenzene	<1.0	1.0	
			1,3-Dichlorobenzene	<1.0	1.0	
			1,4-Dichlorobenzene	<1.0	1.0	
			p-Isopropyltoluene	<1.0	1.0	
			1,2-Dichlorobenzene	<1.0	1.0	
			n-Butylbenzene	<1.0	1.0	
			1,2-Dibromo-3-Chloropropane	<1.0	1.0	
			1,2,4-Trichlorobenzene	<1.0	1.0	
			Naphthalene	<1.0	1.0	
			Hexachlorobutadiene	<1.0	1.0	
			1,2,3-Trichlorobenzene	<1.0	1.0	
			Acetone	<20	20	
			Methyl Ethyl Ketone	<10	10	
			Dichlorodifluoromethane	<1.0	1.0	
			Chloromethane	<1.0	1.0	
			Vinyl Chloride	<1.0	1.0	
			Bromomethane	<1.0	1.0	
			Chloroethane	<1.0	1.0	
			Trichlorofluoromethane	<1.0	1.0	
			2-Chloroethylvinylether	<1.0	1.0	
			Carbon Disulfide	<1.0	1.0	
			Vinyl Acetate	<1.0	1.0	
			Methyl Isobutyl Ketone	<10	10	
			2-Hexanone	<10	10	
			Acrolein	<10	10	
			Acrylonitrile	<10	10	
			Methyltertiary Butyl Ether	<1.0	1.0	
			Iodomethane	<1.0	1.0	
		Surrogate Recoveries				
			1,2-Dichloroethane-d4	100		% Recovery
			Toluene-d8	100		
			4-Bromofluorobenzene	100		

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

RH:05-21-96

Trip Blank — 8260 LONG

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries		% Recovery
	1,2-Dichloroethane-d4	99
	Toluene-d8	103
	4-Bromofluorobenzene	101

ENERGY LABORATORIES, INC.
P.O. Box 2470 610 Farnwood Street voice 605-342-1225
Rapid City, SD 57709 fax 605-342-1397

CHAIN OF CUSTODY RECORD

PLEASE PRINT OR TYPE ALL INFORMATION EXCEPT SIGNATURES

P.O. # | Project Name / Address: ELLSWORTH AFB, RADIAN, PRIDE HANGAR

Contact Name & Phone: JAMES MACHIN

Sampler's signature:

Invoice to:

Report to:

DATE	TIME	composite	grab sample	SAMPLE I.D.	number of containers	Sample Type: A Air W Water S Soils/solids V Vegetation U Urine O Other	Analysis Requested: 8260	Comments, Special Instructions, etc.
5/16/96	0700			EFFLUENT DISCHARGE # 6	1	W	✓	
5/16/96	0945			~~Pre Test~~ Jim EW-1 Post Test	3	W	✓	
5/16/96	0950			EW-1D Post Test	3	W	✓	
5/16/96	1700			EW-2 Pre Test	3	W	✓	Rush
				Trip Blanks	2			

1. Relinquished (signature)	Date	Time	Received by: (signature)	3. Relinquished (signature)	Date	Time	Received by (signature):
	5/17/96	8:15					
2. Relinquished (signature)	Date	Time	Received by: (signature)	4. Relinquished (signature)	Date	Time	Received for laboratory by (signature):
					5/17/96	8:15	Marcie Sprague

APPENDIX D

Vapor Sample Analytical Data

MICROSEEPS

University of Pittsburgh Applied Research Center
220 William Pitt Way, Pittsburgh, PA 15238
(412) 826-5245
FAX (412) 826-3433

May 24, 1996

Mr. Bill Buchans
Radian International
1093 Commerce Park Drive
Oak Ridge, TN 37830

Dear Mr. Buchans:

Attached is the final data listing for the samples we received on May 22, 1996, your project #612-001-31-30.

Please give me call if you have questions or I can be of further assistance. Thank you for using MICROSEEPS.

Sincerely,

David J. Masdea

DJM/lsp

Attachment: RAD74-962412

MICROSEEPS

ANALYSIS OF VOLATILE ORGANICS IN GAS SAMPLES

Gas samples are received and secured in accordance with Microseeps documented sample receipt procedures. Analyses are performed using Microseeps Analytical Method AM4.03. Analytical method AM4.03 is a modification of USEPA Method 3810 (Headspace) and 8000 (Gas Chromatography). Modifications implemented are to accommodate the gas phase sample type only. All applicable quality control procedures are followed including continuing calibration check standards and laboratory blanks. Microseeps Analytical Method AM4.03 will be supplied upon request.

220 William Pitt Way, Pittsburgh, PA 15238 • Phone (412) 826-5245, Fax (412) 826-3433

MICROSEEPS

RAD74-962412

----- RADIAN INTERNATIONAL ----

----- PROJECT LOC: ELLSWORTH AFB -----

----- PROJECT NO: 612-001-31-30 -----

----- 601/602 SCAN -----

----- CONCENTRATIONS IN PPMV -----

	SAMPLE ID	SAMPLE ID	SAMPLE ID	SAMPLE ID	
COMPOUND NAME	PRIDE V-1	PRIDE V-2	PRIDE V-3	PRIDE V-4	LDLs
CHLOROMETHANE	<1	<1	<1	<1	1
VINYL CHLORIDE	<1	<1	<1	<1	1
BROMOMETHANE/CHLOROETHANE*	<1	<1	<1	<1	1
FLUOROTRICHLOROMETHANE	<.005	<.005	<.005	<.005	0.005
1,1 DICHLOROETHYLENE	<.01	<.01	<.01	<.01	0.01
METHYLENE CHLORIDE	<1	<1	<1	<1	1
TRANS-1,2 DICHLOROETHYLENE	<.1	<.1	<.1	<.1	0.1
1,1 DICHLOROETHANE	<.01	<.01	<.01	0.02	0.01
CHLOROFORM	<.005	<.005	<.005	<.005	0.005
1,1,1 TRICHLOROETHANE	<.005	<.005	<.005	<.005	0.005
CARBON TETRACHLORIDE	<.005	<.005	<.005	<.005	0.005
BENZENE	<.07	<.07	<.07	<.07	0.07
1,2 DICHLOROETHANE	<.01	<.01	<.01	<.01	0.01
TRICHLOROETHYLENE	0.401	1.720	3.802	6.011	0.005
1,2 DICHLOROPROPANE	<.01	<.01	<.01	<.01	0.01
BROMODICHLOROMETHANE	<.005	<.005	<.005	<.005	0.005
CIS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	<.01	0.01
TOLUENE	0.12	<.07	<.07	<.07	0.07
TRANS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	<.01	0.01
1,1,2 TRICHLOROETHANE	<.005	<.005	<.005	<.005	0.005
TETRACHLOROETHYLENE	0.013	<.005	<.005	<.005	0.005
CHLORODIBROMOMETHANE	<.005	<.005	<.005	<.005	0.005
CHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
ETHYL BENZENE	<.07	<.07	<.07	<.07	0.07
BROMOFORM	<.005	<.005	<.005	<.005	0.005
1,1,2,2 TETRACHLOROETHANE	<.005	<.005	<.005	<.005	0.005
1,3 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
1,4 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
1,2 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
ADDITIONAL ANALYSIS					
CIS-1,2 DICHLOROETHYLENE	<.01	<.01	<.01	<.01	0.01
FILE NAME	W62 281	W62 282	W62 283	W62 284	
DATE SAMPLED	05/14/96	05/14/96	05/15/96	05/15/96	
DATE RECEIVED	05/22/96	05/22/96	05/22/96	05/22/96	
DATE ANALYZED	05/23/96	05/23/96	05/23/96	05/23/96	

* COMPOUNDS ELUTE TOGETHER ON ECD: VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.

23-May-96

ANALYST INITIALS: 

LAB MANAGER INITIALS DJM

MICROSEEPS

RAD74-962412

----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

	SAMPLE ID	SAMPLE ID	SAMPLE ID	
COMPOUND NAME	PRIDE V-5	PRIDE V-6	PRIDE V-6D	LDLs
CHLOROMETHANE	<1	<1	<1	1
VINYL CHLORIDE	<1	<1	<1	1
BROMOMETHANE/CHLOROETHANE*	<1	<1	<1	1
FLUOROTRICHLOROMETHANE	<.005	<.005	<.005	0.005
1,1 DICHLOROETHYLENE	<.01	<.01	<.01	0.01
METHYLENE CHLORIDE	<1	<1	<1	1
TRANS-1,2 DICHLOROETHYLENE	<.1	<.1	<.1	0.1
1,1 DICHLOROETHANE	0.12	0.23	0.23	0.01
CHLOROFORM	0.005	0.009	0.009	0.005
1,1,1 TRICHLOROETHANE	<.005	<.005	<.005	0.005
CARBON TETRACHLORIDE	<.005	<.005	<.005	0.005
BENZENE	<.07	<.07	<.07	0.07
1,2 DICHLOROETHANE	<.01	<.01	<.01	0.01
TRICHLOROETHYLENE	11.090	23.365	22.170	0.005
1,2 DICHLOROPROPANE	<.01	<.01	<.01	0.01
BROMODICHLOROMETHANE	<.005	<.005	<.005	0.005
CIS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	0.01
TOLUENE	<.07	0.09	0.08	0.07
TRANS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	0.01
1,1,2 TRICHLOROETHANE	<.005	<.005	<.005	0.005
TETRACHLOROETHYLENE	<.005	0.006	0.005	0.005
CHLORODIBROMOMETHANE	<.005	<.005	<.005	0.005
CHLOROBENZENE	<.07	<.07	<.07	0.07
ETHYL BENZENE	<.07	<.07	<.07	0.07
BROMOFORM	<.005	<.005	<.005	0.005
1,1,2,2 TETRACHLOROETHANE	<.005	<.005	<.005	0.005
1,3 DICHLOROBENZENE	<.07	<.07	<.07	0.07
1,4 DICHLOROBENZENE	<.07	<.07	<.07	0.07
1,2 DICHLOROBENZENE	<.07	<.07	<.07	0.07
ADDITIONAL ANALYSIS				
CIS-1,2 DICHLOROETHYLENE	<.01	<.01	<.01	0.01
FILE NAME	W62 285	W62 286	W62 287	
DATE SAMPLED	05/16/96	05/16/96	05/16/96	
DATE RECEIVED	05/22/96	05/22/96	05/22/96	
DATE ANALYZED	05/23/96	05/23/96	05/23/96	

* COMPOUNDS ELUTE TOGETHER ON ECD: VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.

24-May-96

ANALYST INITIALS

LAB MANAGER INITIALS

MICROSEEPS

RAD74-962412

**** QUALITY CONTROL ****
----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

CONTINUING CALIBRATION CHECK

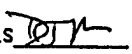
STANDARDS: "624"(LEVEL 2), "624"(LEVEL 1), "VC-996", "CIS"
REFERENCE: W62A/B269, W62A/B271, W62A273, W62B272

COMPOUND	KNOWN	RESULT	PERCENT DIFFERENCE
CHLOROMETHANE	20.8	21.8	4.82
VINYL CHLORIDE	996.0	965.5	3.06
BROMOMETHANE/CHLOROETHANE*	2.7	3.0	11.07
FLUOROTRICHLOROMETHANE	0.765	0.803	4.97
1,1 DICHLOROETHYLENE	1.09	1.07	1.66
METHYLENE CHLORIDE	1.24	1.28	3.39
TRANS-1,2 DICHLOROETHYLENE	1.09	1.18	8.29
1,1 DICHLOROETHANE	1.06	1.13	6.68
CHLOROFORM	0.881	0.935	6.13
1,1,1 TRICHLOROETHANE	0.788	0.831	5.46
CARBON TETRACHLORIDE	0.684	0.711	3.95
BENZENE & 1,2-DCA**	2.41	2.36	1.91
1,2 DICHLOROETHANE	1.06	1.14	7.34
TRICHLOROETHYLENE	0.800	0.852	6.50
1,2 DICHLOROPROPANE	0.93	1.00	7.09
BROMODICHLOROMETHANE	0.642	0.682	6.23
CIS-1,3 DICHLOROPROPYLENE	0.95	1.01	6.75
TOLUENE	1.14	1.13	1.14
TRANS-1,3 DICHLOROPROPYLENE	0.95	1.01	6.54
1,1,2 TRICHLOROETHANE	0.788	0.848	7.61
TETRACHLOROETHYLENE	0.634	0.664	4.73
CHLORODIBROMOMETHANE	0.505	0.538	6.53
CHLOROBENZENE	0.93	0.95	1.50
ETHYL BENZENE	0.99	0.99	0.40
BROMOFORM	0.416	0.450	8.17
1,1,2,2 TETRACHLOROETHANE	0.626	0.668	6.71
1,3 DICHLOROBENZENE	7.15	8.11	13.47
1,4 DICHLOROBENZENE	7.15	8.07	12.92
1,2 DICHLOROBENZENE	7.15	8.12	13.61
CIS-1,2 DICHLOROETHYLENE	27.20	29.43	8.20

* COMPOUNDS ELUTE TOGETHER ON ECD: VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.
** COMPOUNDS ELUTE TOGETHER ON FID - VALUE REPRESENTS A COMBINATION OF BOTH.

23-May-96

ANALYST INITIALS 

LAB MANAGER INITIALS 

MICROSEEPS

RAD74-962412

**** QUALITY CONTROL ****
----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

LABORATORY BLANK RESULTS

BLANK: N2 IN VIAL
REFERENCE: W62A/B280

COMPOUND	BLANK	LOWER DETECTION LIMIT
CHLOROMETHANE	ND	1.0
VINYL CHLORIDE	ND	1.0
BROMOMETHANE/CHLOROETHANE*	ND	1.0
FLUOROTRICHLOROMETHANE	ND	0.005
1,1 DICHLOROETHYLENE	ND	0.01
METHYLENE CHLORIDE	ND	1.00
TRANS-1,2 DICHLOROETHYLENE	ND	0.10
1,1 DICHLOROETHANE	ND	0.01
CHLOROFORM	ND	0.005
1,1,1 TRICHLOROETHANE	ND	0.005
CARBON TETRACHLORIDE	ND	0.005
BENZENE	ND	0.07
1,2 DICHLOROETHANE	ND	0.01
TRICHLOROETHYLENE	ND	0.005
1,2 DICHLOROPROPANE	ND	0.01
BROMODICHLOROMETHANE	ND	0.005
CIS-1,3 DICHLOROPROPYLENE	ND	0.01
TOLUENE	ND	0.07
TRANS-1,3 DICHLOROPROPYLENE	ND	0.01
1,1,2 TRICHLOROETHANE	ND	0.005
TETRACHLOROETHYLENE	ND	0.005
CHLORODIBROMOMETHANE	ND	0.005
CHLOROBENZENE	ND	0.07
ETHYL BENZENE	ND	0.07
BROMOFORM	ND	0.005
1,1,2,2 TETRACHLOROETHANE	ND	0.005
1,3 DICHLOROBENZENE	ND	0.07
1,4 DICHLOROBENZENE	ND	0.07
1,2 DICHLOROBENZENE	ND	0.07
CIS-1,2 DICHLOROETHYLENE	ND	0.01

* COMPOUNDS ELUTE TOGETHER ON ECD - VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.

23-May-96

ANALYST INITIALS

LAB MANAGER INITIALS

RAD 74 – 96 2412

MICROSEEPS, Inc.

220 William Pitt Way, Pittsburgh, PA 15238

Phone: (412) 826-5245 Fax: (412) 826-3433

CHAIN-OF-CUSTODY RECORD

Company Name: Radian International

Address: PO Box 201088, Austin, TX 78720

Proj. Manager: James Machin / Bill Buchanan

Proj. Location: Allsworth AFB

Proj. Number: 612-001-31-30

Phone # : 512/419-5210 Fax # : 512/454-8807

Sampler's signature : J. Machin

Note: Enter proper letters in Requested Analyses columns below.

Note: If analysis D,E,or K is selected, scratch (option) NOT wanted.

Analysis Options

* A	C1 -C4	G	Chlorinated HC
* B	Hydrogen & Helium	H	BTEX
* C	Permanent Gases (CH4, CO, CO2, N2, O2)	J	BTEX & C5 - C10
D	Mercury (Soil) or (Air **)	K	TPH (C5 - C10) or (C4 -C12)
E	TO-14 by GC/MS (Ambient) or (Source **)	L	C11 - C18
F	601 & 602 Compounds	Other	Specify below.

* An additional 22 ml vial of sample is required when requested in combination with another analysis.

** Available upon request.

Collection Date	Collection Time	Number of Containers	"Summa" # if Can. used	Sample Type	Sample Identification	Requested Analyses					(Other)	Remarks
5/14/96	1600	2		Vials	Pride V-1	F					Cis-1,2 DCE	AM 4.03
5/14/96	1900	1		Vials	Pride V-2	F					Cis-1,2 DCE	AM 4.03
5/15/96	1010	1		VIAL	PRIDE V-3	F					Cis-1,2 DCE	AM 4.03
5/15/96	1445	1		VIAL	PRIDE V-4	F					Cis-1,2 DCE	AM 4.03
5/16/96	0610	2		VIAL	PRIDE V-5	F					Cis-1,2 DCE	AM 4.03
5/16/96	0700	2		VIAL	PRIDE V-6	F					Cis-1,2 DCE	AM 4.03
5/16/96	0700	2		VIAL	PRIDE V-6 D	F					Cis-1,2 DCE	AM 4.03

D-7

Results to : JAMES MACHIN @ RADIAN P.O. BOX 201088 AUSTIN TX 78720 / BILL BUCHANAN @ RADIAN 1093 COMMERCE PARK DR OAK RIDGE TN 37830

Invoice to : JAMES MACHIN @ RADIAN P.O. BOX 201088 AUSTIN TX 78720

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Bill Buchanan	RADIAN	21 MAY 96	1445PM	J. Mentore	MICROSEEPS	5/22/96	1130
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Laboratory to return YELLOW COPY : Laboratory PINK COPY : Submitter